73 AMATEUR RADIO

International Edition

JUNE 1989
ISSUE #345
USA $2.95
CAN $3.95

A WGE Publication

QRP Home-Brew!

Three great rigs for 80-20 meters!
6m low-power fun
Simple SWR bridge

Reviews:

Micro HT wonder
Low-cost 100W 10m action
Butane soldering iron!
Tune to a "T"

Plus:

Net/ROM vs. TheNet
—case of software piracy?
A look at Spread Spectrum
More on hamsat telemetry
220 MHz transverter PA

06
0 74820 08725 1

'MOST RELIABLE HF'

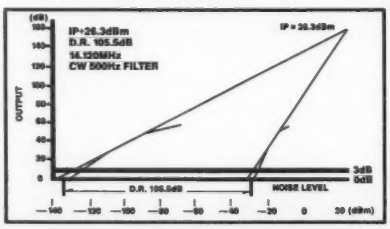
"Of all the possible radios, I chose the ICOM IC-735 for my CQWW QRP world record attempt."

Danny Eskenazi, K7SS, World High QRP Score
-1987 CQWW SSB (PJ2/FR)*
-1986 CQWPX SSB (K7SS/WH6)
-1986 ARRL DX PHONE & CW (K7SS/KH6)

ICOM's IC-735 is the world's most popular HF transceiver. With the highest performance, smallest size, and best customer satisfaction of any HF transceiver, the IC-735 is the winner's choice for fixed, portable, or mobile operations.

- **Field Proven 100W Transmitter** with 100% duty cycle. Proudly backed with ICOM's full one-year warranty.
- **105dB Dynamic Range Receiver** includes passband tuning, IF notch, adjustable noise blanker, and semi or full CW QSK.
- **Conveniently Designed.** Measures only 3.7"H by 9.5"W by 9"D.

- **Optional AH-2 Automatic Tuning Mobile Antenna System** covers 3.5MHz-30MHz and tracks with the IC-735's tuned frequencies.
- **All HF Amateur Bands and Modes** plus general coverage reception from 100KHz-30MHz.



- **12 Tunable Memories** operate and reprogram like 12 separate VFO's. Supreme flexibility!

Additional Options: SM-10 graphic equalized mic. PS-55 AC power supply, AT-150 automatic antenna tuner for base operation.

ICOM's IC-735... a proven winner for reliable worldwide HF communications. See it today at your local ICOM dealer.

ICOM

ICOM America, Inc.

2380 116th Avenue N.E., Bellevue, WA 98004
Customer Service Hotline (206) 454-7619
3150 Premier Drive, Suite 126, Irving, TX 75063
1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc.,
3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4

All stated specifications subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 735189.
*Final contest results pending.

CIRCLE 354 ON READER SERVICE CARD

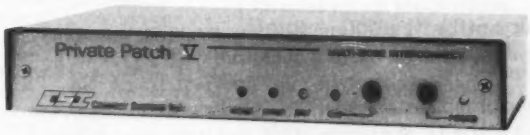
LOOKING FOR AN AUTOPATCH OR REPEATER CONTROLLER?

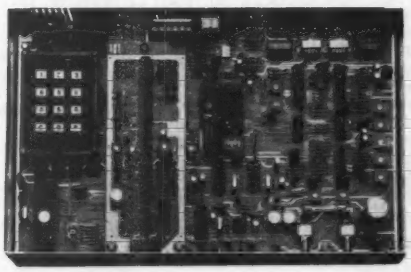
	PRIVATE PATCH V	510SA-II	510SA
Auto-dialer	90 phone numbers	None	None
Last number redial	Yes	No	No
Hook flash	Yes	No	No
Programming keyboard	Built-in	Plug-in	None
Programming digital display	Yes	No	No
Noise filter	5 pole	2 pole	2 pole
Regenerated DTMF dialing	Yes	No	No
DTMF decode LED	Yes	No	No
Selectable VOX simplex, sampling simplex, duplex and repeater controller operating modes	Yes	No	No
Number of keyboard selectable sampling mode VOX enhancement ratios	8	2	None
Operates through repeaters	Yes	No	No
Method of connection to base radio	Internal or External	Internal Only	Internal Only
CPU program memory	8k	2k	2k
Busy signal disconnect	Yes	No	No
Dialtone disconnect	Yes	No	No
Selectable three digit repeater mode on/off code	Yes	No	No
Remotely controllable internal aux relay	Yes	No	No
Optional CTCSS board available	Yes	No	No
Optional voice delay board available	Yes	No	No
Warranty	1 Year	6 Mo.	6 Mo.

When you compare Private Patch V to the competition, the choice is clear!

ADDITIONAL FEATURES

- **USER PROGRAMMABLE CW ID**
- **DIAL ANY PRE-SELECTED NUMBER BY PRESSING THE MIC BUTTON FIVE TIMES.**
- **COMPLETE PATCH STATUS BEEPS**
- **FRONT PANEL STATUS LEDS**
- **HALF DUPLEX PRIVACY MODE** (with beeps)
- **SELECTABLE CONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL OVERRIDE CODE 2-5 DIGITS**
- **SELECTABLE DISCONNECT CODE 1-5 DIGITS**
- **SELECTABLE TOLL RESTRICTION:**
  - First digit lockout
  - Prefix lockout
  - Digit counting
- **SELECTABLE ACTIVITY/TIMEOUT TIMERS**
- **RINGOUT**
  (Receive your calls in the mobile)
- **RING COUNTING**
  (Ringout alerts after pre-selected no. of rings)
- **REMOTE BASE**
  (Use your base radio from any telephone)
- **LAND TO MOBILE SELECTIVE CALLING**
- **INTERNALLY SQUELCHED AUDIO**
- **MOV LIGHTING PROTECTORS**
- **SELECTABLE TONE OR PULSE DIALING**





Note built-in programming keyboard and digital display just above keyboard.

CONNECT SYSTEMS INC.

2064 Eastman Ave. #113 • Ventura, CA 93003
Phone (805) 642-7184 • FAX (805) 642-7271

CIRCLE 12 ON READER SERVICE CARD

Welcome, Newcomers!

WHAT IS QRP?

Amateur radio lingo is full of abbreviations and code words, which evolved in the days of CW (Morse Code)-only communications. Many common statements and questions, such as "Do you copy?", "My location is...", "Please send more slowly", etc., have been reduced to three-letter statements/questions beginning with "Q." This gave CW communications—a much slower mode than spoken ("voice") communications—greater efficiency.

QRP means "reduce your power." Hams who enjoy low-power operation became known as QRPers. The unofficial maximum power level for QRP operation is 10 Watts. One Watt or less of transmitted power is called QRP operation.

At first, many hams ask, "What's the point in QRP operation?" Mayhem often reigns on the bands during periods of good **propagation**, with some hams running a **full gallon** plus battling it out. "How can the **little gun** hope to compete?" "Why would anyone *want* to be a little gun?"

To be sure, there are reluctant QRPers—hams who make do with the equipment they have until they save up enough to run out and buy a 100 Watt output **rig** and/or a **linear amp**. QRP has a large devoted following, however. There's obviously much more to QRP than first meets the ear, as this issue will attempt to show.

The Elegance of QRP

A QRP station can be very small—there are QRP transceivers that can fit in the palm of your hand! QRP rigs are much simpler devices than their high-powered brothers, since there are fewer stages of circuitry in the rig to step up the power of the signal and ensure signal **linearity** and **purity**. One- or two-afternoon QRP transceiver projects abound—Mike Bryce's QRP column is full of 'em. For hams who actually want to *apply* the electronic theory they learned (or memorized) for their exam, building a QRP rig is a great place to start—very little can match the thrill of making a **DX** contact on a piece of equipment that you've built yourself!

Craft Instead of Kilowatts

Let's say you've built your pocket-sized 5 Watt rig on Friday night and Saturday, and hanker to get on the air on Sunday. You know, however, that when propagation is good, the bands are often wall-to-wall booming signals. What to do?

QRPers have to be a tenacious breed, but they soon learn that power is not the only factor in making a contact. They bag many of their contacts when a particular band just opens up, before most other hams become aware of it. This doesn't mean that QRPers sit by their rigs 24 hours a day—many band openings are predictable. A QRPer soon becomes skilled in the science of propagation.

The science is far from exact. There are unpredictable bands. Ten meters is often closed, especially during low sunspot activity, but it can **open up** very suddenly at different times of the day. This band needs more monitoring, but then the chances are better that fewer people will become aware of its opening, and the QRPer has a longer opportunity to work DX. When propagation is good, your signal can be *milliwatts* and still get a good report from a DX station.

A Little Antenna Math

A QRPer's best edge is a high-gain antenna system. Improvements here pay dividends at *both* ends of the path—receiving ("hearing") and transmitting ("talking").

What does gain mean? Gain is simply a *ratio*, usually expressed in decibels (dB). When you talk about an antenna having a certain gain, you must specify gain *over a reference antenna*. Logically, gain relates not only to the **effective radiated powers (ERPs)** of a pair of antenna systems, but also to the received signal gains of the same system pair.

An antenna's ERP increases logarithmically with its gain. Here's a handy rule of thumb: every 3 dB gain increase doubles the ERP. For example, a 3 dB antenna has twice the ERP over a given reference; a 6 dB antenna has four times the ERP over that reference. A 9 dB antenna?—eight times the ERP!

What's a good reference antenna? One of the most common ham antennas is the ½-wave dipole. To note it as the reference, we tack a "d" on the end of "dB."

Ten dBd gain is a reasonable figure for a typical directional beam antenna that you can buy for a few hundred dollars, or build for less. By the above logarithmic scale, you can intuit that 10 dB is about 10 times the ERP gain. This means that the operator feeding 10 Watts into a 10 dBd beam has the same chances of making himself heard to that DX station as the op putting 100 Watts into his dipole!

Can 10 Watts into a 10 dBd gain antenna really compete with the rest of hamdom? You bet! Most hams live in areas that restrict antenna systems. A city lot may not provide room for more than a dipole or a vertical antenna. (A vertical has similar gain to a dipole). Most hams don't run more than 100 Watts into an antenna system since that is the typical limit for an unassisted transceiver, and linear amps are too pricey.

Clearly, a QRPer with a good antenna system is really in the running!

Hats Off to QRPers

The finest point of QRP operation is that it forces the ham to *think*. He has to experiment with his equipment—installing narrow filters, improving the gain of his antenna system, etc.—and learn about propagation. The QRPer avoids the all-too-easy solution of cranking up the power to get through the crowds, which very easily leads to crowding out others. He shows courtesy to his fellow hams by almost never running more power out than necessary to conduct a contact (which is, incidentally, an FCC rule!). This is what separates the QRPers, who practice two critical mandates of the hobby—advancing the state of the art and fraternal goodwill—from the emerging throng of appliance operators who treat the linear amp as a cure-all.

This issue has a host of simple QRP transceiver construction projects to get you active on most of the **HF** bands. Happy home-brewing, and let us hear from you! 73

...de NS1B

GLOSSARY

DX—Abbreviation for Long Distance. DX for the HF bands is typically transcontinental.

ERP—The power measure of the wave energy that radiates from an antenna that is the product of the input power into the antenna system and the net gain of the antenna system.

Full-gallon—Ham jargon for a kilowatt of output power.

HF—High Frequency. Refers to the 80–10 meter (3–30 MHz) bands. 160 meters (1.8–2.0 MHz) is US Amateur Radio's only Medium Frequency (MF) band.

Linear Amp—Short for linear amplifier. This device takes an input signal and increases its power without (ideally) changing any of its other characteristics.

Linearity—An expression of the resemblance between the input and output signals of a circuit. The better the linearity of a circuit, the less it distorts a signal.

Open up—Ham jargon meaning "provide good propagation."

Propagation—The transfer of energy (in this case, electromagnetic energy) through a medium, such as the atmosphere or space.

Purity—Most often an expression relating the power of the fundamental frequency of a signal and the power of its non-fundamental frequencies, such as harmonics. The purer a signal, the more pronounced its fundamental relative to its non-fundamentals.

Rig—Ham jargon for transceiver.

Transceiver—A radio set that contains a receiver and a transmitter in the same chassis.

QRM

Editorial Offices
WGE Center
Hancock NH 03449
phone: 603-525-4201

Advertising Offices
WGE Center
Hancock NH 03449
phone: 800-225-5083

Circulation Offices
WGE Center
Hancock NH 03449
phone : 603-525-4201

Manuscripts

Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon publication. A premium will be paid for accepted articles that have been submitted electronically (CompuServe ppn 70310,775 or MCI Mail "WGEPUB") or on disk as an IBM-compatible ASCII file. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

73 Amateur Radio (ISSN 0889-5309) is published monthly by WGE Publishing, Inc., WGE Center, Forest Road, Hancock, New Hampshire 03449. Entire contents ©1989 by WGE Publishing, Inc. No part of this publication may be reproduced without written permission from the publisher. For Subscription Services write *73 Amateur Radio*, PO Box 58866, Boulder, CO 80322-8866, or call 1-800-289-0388. In CO call 1-303-447-9330. The subscription rate is: one year $24.97; two years $39.97. Additional postage for Canada is $7.00 and for other foreign countries, $19.00 surface and $37.00 airmail per year. All foreign orders must be accompanied by payment in US funds. Second class postage paid at Hancock, New Hampshire and at additional mailing offices. Canadian second class mail registration number 9566. Microfilm Edition—University Microfilm, Ann Arbor, MI 48106. Postmaster: send address changes to *73 Amateur Radio*, PO Box 58866, Boulder, CO 80322-8866.

Contract:

The mere reading of this contract between you and *73 Magazine* is acceptable evidence of your total and unequivocable agreement to its terms. If you want out now, too bad. You have hereby agreed to the following: to do everything in your power to get the ARRL to push the FCC for a no-code license, to get your local ham club to sponsor school radio clubs in all area schools, to stop smoking, to embark on a serious diet so that you won't contribute to the burgeoning list of Silent Keys, to turn in your parents if they are using illegal drugs, to make sure Wayne Green's talks at hamfests are packed, to build at least four homebrew projects per year, to use the Reader Feedback cards to vote on the articles, to send in the Reader Service card every month, and to buy at least three products advertised in *73* each year.

73 AMATEUR RADIO

JUNE 1989 Issue # 345

TABLE OF CONTENTS

FEATURES

12 Spread-Spectrum
Hams, too, can use this mode! N4ICK

34 The Net/ROM-NordLink Question
Bootlegged software? WB2KQI

58 Decoding OSCAR Telemetry, Part II
Learn about the state of F-O-12 and OSCARs-to-be. G3RUH

HOME-BREW

20 QRP CW Transceiver
Enjoy 30 or 40m QRP operation with this easy-to-build rig. ..... NZ5G and N5HNN

26 The G3IGU Transceiver
Designed for 80m QRP fun. G3IGU

38 The 220 MHz DMOS Linear Amplifier Project
Give a boost to the January '89 *73* transverter project. W6YUY

44 QRP SWR Bridge
Antenna system matched to the rig? Find out with the bridge. G4FAI

50 Six Meter QRP Station
Build this golden oldie to get on this now-active band. ex-YU1FR

65 CW Transceiver for 20 Meters
Take the challenge of 20m QRP. G3YCC

REVIEWS

14 Yaesu FT-411
Ever smaller and fuller-featured KB1UM

30 Ranger AR-3500
100W 10m rig for $350? Read about it here! N1BLH

36 Portasol Butane Soldering Pencil
Unique approach to cordless soldering WB9RRT

42 MFJ Differential-T Antenna Tuner
A simpler, surer tuner WA4BLC

54 Antennas West Solar Power Supply
Durable, portable solar panel WB8VGE

82 Wilson 1000 Mobile Antenna
For 10m mobile QRO N1BLH

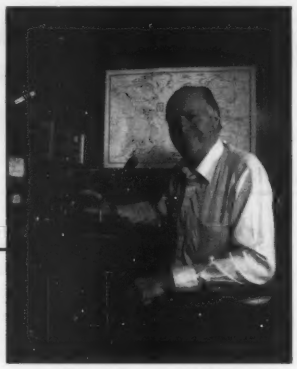
DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

80 Ad Index
70 Above and Beyond
74 Ask Kaboom
94 Barter 'N Buy
61 Circuits
92 Dealer Directory
88 DX
17 Feedback
53 Ham Help
71 Index: 6/89
84 Letters
81 Looking West
6 Never Say Die
78 New Products
95 Propagation
76 QRP
9 QRX
72 RTTY Loop
86 73 International
89 Special Events
4 Welcome Newcomers

Cover by Marilyn Moran; Cover photo by John Shotwell: Bruce NZ5G and Bill N5HNN show you how to build a rig to work the world.

Number 2 on your Feedback card



NEVER SAY DIE

Wayne Green W2NSD/1

Oh Darn, My Kid's Gone Bad

If you read much, you've been reading about the sorry state of American education. There's less being written about why our educational system isn't working, but since it's going to be difficult to fix it if we don't know why it's broken, perhaps we need to not just be aware of the problem, but to also find out what went wrong.

We know that amateur radio is broken, too. We also know when it broke and why, but we don't know how to fix it because we find ourselves running into some of the same problems as we do in education.

Amateur radio went along pretty well from 1946 until 1963, growing at 11% per year for this 17-year period. Then, suddenly, it died. We're not talking about a gradual drop, we're talking a cataclysm–a drop in ham sales of 85% in one year! A drop from an 11% growth to a 5% loss in one year! We're talking a loss of 85% of our ham dealers and most of our manufacturers within a few months!

While the "Incentive Licensing" proposal by the ARRL nuked the hobby, there were several other factors which tended to exacerbate the situation. They couldn't have picked a worse time in history to pull what the ARRL directors considered was primarily a publicity stunt to focus attention on the League.

Here we were, in the depths of a sun spot low, so the bands were in terrible shape. Hamming was at its worst as far as operator frustrations were concerned. This, in itself, would tend to exaggerate any negatives. Ten was dead as a doornail. Twenty was closed at night, and stinky even during the best of days. Eighty was awful, with the normal local area contacts sometimes almost impossible. It just wouldn't take much to get a lot of hams to chuck it all in and sell their rigs at a frustrating time like this.

In addition to that, we had the FCC starting to charge us for our licenses. It wasn't much, nowhere near what we were costing them, but many hams were able to blow this all out of proportion. Eventually the FCC got stopped by the courts and had to give back much of the money. But in the meantime, it was one more large straw on our backs. One more frustration.

There's more. These were the '60s, complete with rebelling youngsters—the combined products of several major changes in our whole basic culture. There was the incredible influence of Dr. Spock, with his "let your kid do his own thing" approach to child non-training. There also was the impact of the two-worker family, where the mother was no longer at home to bring up the children.

There's more. Added to Dr. Spock and the working mother, we also had the pernicious influence of TV—not just on the kids, but also on the whole family. This was the first generation of kids which grew up with the TV set on all day every day at home. TV was the baby sitter, and then the chewing gum of the mind. It kept the kids from doing their homework. No problem, get the schools to stop bothering us with homework.

So into this powder keg the League dropped the Incentive Licensing bomb. It turned what was already a precarious situation into a disaster from which we have never recovered. Within a couple of years we lost not only our ham dealers and manufacturers, but we also lost a large percentage of our old-time ham clubs, and almost all of our school radio clubs.

The school clubs were the worst loss of all because that wiped out the infrastructure which had been bringing us 80% of our new hams. By 1970, when the sun spots were peaking again, we were able to get back to a small growth. The enormous interest in FM and repeaters, plus a supply of frustrated CBers, also contributed to this slight growth.

So what's happened to amateur radio, other than the Incentive Licensing catastrophe, has been symptomatic of the problems America has had with its kids and with education.

Let's look at this another way to understand it better. If you buy a dog and bring it into your home to live with you, unless you take some time to train that dog, you're going to have a pest who is chewing your slippers, barking at night, jumping on people, begging for food at the table and so on.

Dogs eagerly take to training. It doesn't even take very long, if you bother to learn how to do it. They are happier and more comfortable when they are trained. They need to understand what's expected of them and to know that they're loved. Dogs will do almost anything for love. But if you use punishment to try and train them, you're not going to have a happy dog, nor a trained one.

Isn't it odd how parallel the training of kids is to training dogs? You get out of a dog what you put in. If you put in some time and love you'll get a happy, well-behaved dog who will give love right back. If you put love into a kid you'll get the same. Is that a news flash?

So how do most people train their kids? With gripes about their failures (punishment), with nagging, and with withholding love. Isn't it absolutely amazing how badly this has worked out?

Well, providing you, unlike your kids,

continued on p. 90

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

STAFF

PUBLISHER/EDITOR
Wayne Green W2NSD/1

EDITOR IN CHIEF
Bryan Hastings NS1B

MANAGING EDITOR
Hope Currier

SENIOR EDITOR
Linda Reneau

INTERNATIONAL EDITOR
Richard Phenix

EDITORIAL ASSISTANT
Joyce Sawtelle

ART DIRECTOR
Marilyn Moran

JAPANESE TRANSLATOR
David Cowhig WA1LBP

ASSOCIATES
Mike Bryce WB8VGE
Leon Fletcher N6HYK
Jim Gray W1XU
Chod Harris VP2ML
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister WA5ZIB
Bill Pasternak WA6ITF
Mike Stone WB8QCD
Arliss Thompson W7XU

ADVERTISING
1-603-525-4201
1-800-225-5083

SALES MANAGER
Ed Verbin

ADVERTISING SALES
Jim Bail KA1TGA

SALES SERVICES MANAGER
Rebecca Niemela

WGE PUBLISHING, INC.

CHIEF FINANCIAL OFFICER
Tim Pelkey

CIRCULATION DIRECTOR
Rodney Bell

TYPESETTING/PAGINATION
Steve Jewett KA1MPM, Susan Allen, Linda Drew, Ruth Benedict

GRAPHICS SERVICES
Richard Clarke, Manager
Dale Williams

GRAPHICS PHOTOGRAPHER
Dan Croteau

Editorial Offices
WGE Center
Peterborough, NH 03458-1194
603-525-4201
Subscription Customer Service
1-800-525-0643
Colorado/Foreign Subscribers
call 1-303-447-9330

Wayne Green Enterprises is a division of International Data Group.

Reprints: The first copy of an article—$3.00 (each additional copy—$1.50). Write to 73 Amateur Radio Magazine, WGE Center, Forest Road, Hancock, NH 03449. Attn: Article Reprints

KENWOOD

pacesetter in Amateur Radio

NOW! 70 cm

All Mode Mobility!

TR-751A/851A

Compact all mode transceivers

It's the "New Sound" on the 2 meter band—Kenwood's TR-751A! Automatic mode selection, versatile scanning functions, illuminated multi-function LCD and status lights all contribute to the rig's ease-of-operation. All this and more in a compact package for VHF stations on-the-go!

- Automatic mode selection, plus LSB

144.0 144.1 144.5 145.8 146.0 148.0 MHz

CW	USB	FM	USB	FM

- Optional front panel-selectable 38-tone CTCSS encoder
- Frequency range 142-149 MHz (modifiable to cover 141-151 MHz)
- High performance receiver with GaAs FET front end
- VS-1 voice synthesizer option
- 25 watts high/5 watts adjustable low
- Programmable scanning—memory, band, or mode scan with "COM" channel and priority alert
- 10 memory channels for frequency, mode, CTCSS tone, offset. Two channels for odd splits.
- All mode squelch, noise blanker, and RIT
- Easy-to-read analog S & RF meter

- Dual digital VFOs
- Semi break-in CW with side tone
- MC-48 16-key DTMF hand microphone and microphone hook included
- Frequency lock, offset, reverse switches
- Digital Channel Link (DCL) option

Optional accessories:

- **CD-10** call sign display
- **PS-430, PS-30** DC power supplies
- **SW-100A/B** SWR/power meter
- **SW-200A/B** SWR/power meter
- **SWT-1** 2 m antenna tuner
- **SWT-2** 70 cm antenna tuner
- **TU-7** 38-tone CTCSS encoder
- **MU-1** modem unit for DCL system
- **VS-1** voice synthesizer
- **MB-10** extra mobile mount
- **SP-40, SP-50B** mobile speakers
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MC-60A, MC-80, MC-85** deluxe base station mics.
- **MC-43S** UP/DOWN mic.
- **MC-55** (8-pin) mobile mic.
- **MA-4000** dual band antenna with duplexer

Actual size front panel

TR-851A

70 cm SSB/CW/FM transceiver

The same winning features are yours on 70 cm with the TR-851A!

- Covers 430-439.999 MHz
- 25 W high power/5 W adjustable low
- MC-43S UP/DWN mic. and mic. hook included

KENWOOD

KENWOOD U.S.A. CORPORATION
2201E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.
Specifications guaranteed for the 144-148 MHz Amateur band only.

KENWOOD

pacesetter in Amateur Radio

THE FIRST 144/220 MHz Dual Bander!

Double Take!

ACTUAL SIZE FRONT PANEL

TM-621A/721A

144/220 and 144/450 MHz FM Dual Banders

Once again, Kenwood brings you another Dual Bander First! The TM-621A is the first 144/220 MHz FM Dual Bander. The Kenwood TM-621A and TM-721A (144/450 MHz) re-defines the original Kenwood "Dual Bander" concept. The wide range of innovative features includes a dual channel watch function, selectable full duplex operation, 30 memory channels, extended frequency coverage, large multi-color dual digital LCD displays, programmable scanning, and more!

- **Extended receiver range** (138.000-173.995 MHz) on 2 m; 70 cm coverage is 438.000-449.995 MHz; 1-1/4 m coverage is 215-229.995 MHz. (Specifications guaranteed on Amateur bands only. Two meter transmit range is 144-148 MHz. Modifiable for MARS/CAP. Permits required.)
- **Separate frequency display for "main" and "sub-band."**
- **Call channel function.** A special memory channel for each band stores frequency, offset, and sub-tone of your favorite channel. Simply press the CALL key, and your favorite channel is selected!
- **30 multi-function memory channels.** 14 memory channels and one call channel for each band store frequency, repeater offset, CTCSS, and reverse. Channels "A" and "b" establish upper and lower limits for programmable band scan. Channels "C" and "d" store transmit and receive frequencies independently for "odd splits."
- **45 Watts on 2 m, 35 watts on 70 cm. 25 watts on 1-1/4 m.** Approx. 5 watts low power.
- **Automatic Band Change (A.B.C.)** Automatically changes between main and sub-band when a signal is present.
- **Dual watch function allows VHF and UHF receive simultaneously.**
- **Each function key has a unique tone for positive feedback.**
- **Balance control and separate squelch controls for each band.**
- **Dual antenna ports.**
- **TM-621A has auto offset.**
- **Full duplex operation.**
- **CTCSS encode/decode selectable from front panel** or UP/DWN keys on microphone. (Encode built-in, optional TSU-6 needed for decode.)
- **Programmable memory and band scanning, with memory channel lock-out and priority watch function.**
- **Illuminated front panel controls and keys.**
- **16 key DTMF mic. included.**
- **Handset/remote control option (RC-10).**
- **Frequency (dial) lock.**
- **Supplied accessories:** 16-key DTMF hand mic., mounting bracket, DC cable.

TM-721A shown with optional RC-10.

Optional Accessories:
• **RC-10** Multi-function handset/remote controller • **PS-430** Power supply • **TSU-6** CTCSS decode unit • **SW-100B** Compact SWR/power/volt meter • **SW-200B** Deluxe SWR/power meter • **SWT-1** 2m antenna tuner • **SWT-2** 70 cm antenna tuner • **SP-40** Compact mobile speaker • **SP-50B** Deluxe mobile speaker • **PG-2N** DC cable • **PG-3B** DC line noise filter • **MC-60A, MC-80, MC-85** Base station mics. • **MA-700** Dual band (2 m/70 cm) mobile antenna (mount not supplied) • **MB-11** Mobile bracket • **MC-43S** UP/DWN hand mic. • **MC-48B** 16-key DTMF hand mic.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
Long Beach, CA 90801-5745
KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Apprentice Class?

The push for a no-code licence is gathering more steam. Citing their support from AMSAT, TAPR, and Goldwater, the South Coast Amateur Technical Group, a Melbourne, Florida ARC, filed with the FCC for the creation of a code-free entry-level amateur license. The "Apprentice Class" ticket would replace the current Novice license. Apprentice licensees would have access to all modes and bands above 30 MHz and a full 1500 Watts maximum power output, but the license is good for only one 10-year, non-renewable term.

Space Coast suggests the same testing procedure as for the current Novice class—two examiners with General Class or higher licenses unrelated to the examinee, over the age of eighteen, and not commercially involved in amateur radio. The proposal impacts only on the current Novices, who would be granted Technician privileges for their license terms at the time the Apprentice Class was created.

Expect more such proposals to cross the FCC's plate in the near future. A recent survey by *CQ Magazine*, to which nearly 4500 people have responded so far (especially unusual, considering that the respondents used their own postage), show the no-coders leading the pro-coders by a 60/40 margin.

Siddall

Congratulations to David Siddall K3ZJ, one of amateur radio's greatest supporters in Washington, DC. Dave has been named Assistant Chief of Law for the FCC's Mass Media Bureau, and as such, he will be responsible for the legal review of that bureau's major items. No stranger to the Washington scene, Dave served as Senior Attorney in the FCC's Policy Bureau. Prior to that, he was a Legislative Attorney with the Congressional Research Service of the Library of Congress. K3ZJ is the former president of both the Potomac Valley Radio Club and the Capitol Hill Amateur Radio Society.

73 BBS

73 Magazine BBS is back on line! You again have another way to submit material—opinions, ideas, and, of course, articles—electronically directly to us anytime. You may also download from our growing library of share-ware and public domain programs, and chat directly with the sysop online.

Some may recall last year the brief revival of the *73* BBS, cut short by a hard-disk crash, and the subsequent reallocation of our IBM PC-XT to the company's new Novell token-ring Local Area Network. Well, we're back and better than ever—the new system has a new 20MB hard disk and 60MB digital tape backup, assuring that no data will be lost.

As before, the *73* BBS uses the popular RBBS-PC program. It is a 24-hour/day service, and a sysop attends it for an hour each weekday. Give us a call at (603) 525-4438.

Good Work!

Congrats also to two outstanding members of the ham community. The Dayton Amateur Radio Association (DARA) named Bill Pasternak WA6ITF as 1989 Radio Amateur of the Year. Pasternak, founder of *Westlink Report*, has been the foremost supplier of amateur radio related news to hamdom.

The *Westlink Report* news series appears in hard copy every two weeks, and can be heard weekly on scores of repeater systems throughout the US. In addition, Pasternak founded and sponsored the "Young Ham of the Year Award," and was a leading producer of the award-winning 30-minute video "World of Amateur Radio."

Next, DARA has named Phil Karn KA9Q to receive the Specific Achievement Award. Karn has played a crucial role in the development of packet radio. Packet radio—on the amateur scene for less than 10 years—is a digital mode that has robust error-checking capabilities, channel sharing, and exceptional routing abilities.

Phil's forte in packet is software. He has been instrumental in developing and implementing TCP/IP, a protocol level that serves to interlink heterogeneous packet networks.

Solar Flare

The biggest solar flare in five years erupted March 7. A 43,000 mile-wide sunspot that began spewing X-rays, ultraviolet radiation, radio waves, and electrons "...was one of the most impressive I've heard of in my lifetime," said Patrick McIntosh, project leader for solar physics research at NOAA's Space Environment Lab in Boulder, Colorado.

The huge radiation burst affected radio communications over a two-week period. During this time, many VHF and above operators made auroral skip contacts on weak signal (mainly CW), while many lower-band HF communications were wiped out. Two weeks is the normal time it takes for a sunspot to move across the face of the sun.

Solar flares can occur at any time, but they take place most often near or at the peak of the 11-year sunspot cycle. Scientists quoted by the New York Times say that the the most intense period of solar radiation on record likely lies ahead in the next year. The peak is expected to occur in January or February of 1990.

Though HF communications tend to be disrupted during flares, the general effect of increased sunspot activity is increased ionization of the ionosphere, which aids HF communications. NOW is the time to get active on these bands!

International Doings

Israel: The Israel Amateur Radio Club is taking on the challenge of bringing more youngsters into ham radio. They will adopt the Tel-Aviv Young Generation Repeater into the IARC Repeater Network. The IARC will also donate new hardware to expand the system range. The repeater currently runs only one Watt out, but that will be upped

$$ HOME-BREW IV $$

73 Magazine again invites all home-brewers to turn their hot solder into cold cash and prizes, and to get their name in print to boot. All projects have a chance to appear in the magazine, and we will handsomely reward the authors of the best of these.

Now for the bounty. Ramsey Electronics sweetened the pot from their line of frequency counters. First prize is $300, a 10-year subscription to *73*, and a CT-125 1.25 GHz frequency counter. Second prize is $150, a two-year sub, and a CT-90 600 MHz frequency counter. Third prize is $75, a two-year sub, and a CT-70 525 MHz frequency counter. All this is in addition to the payment every author receives for publishing in *73*.

Contest Rules

1. Entries must be received by 1 July 1989.
2. To enter, write an article describing your best home-brew construction project and submit it to *73*. If you've never written for *73*, send an SASE for a copy of our Writer's Guide, or download it from CompuServe (HamNet forum, Library 0., filename "73WRIT"). *Be sure to state on the submission that it is for the Home-brew IV contest.*
3. Here's the real challenge: The total cost of your project must be under $73, even if all the parts were bought new. Be sure to include a detailed parts list with prices and sources.
4. Our technical staff will evaluate each project on the basis of originality, usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original. That is, they must not be published elsewhere. There is no limit to the number of projects you may enter.
6. If your article is accepted, *73 Magazine* will, upon publication, purchase first North American serial rights.
8. Mail your entries to: *73 Magazine*
WGE Center
Forest Rd.
Hancock NH 03449
Attn: Home-Brew IV

KENWOOD

pacesetter in Amateur Radio

NEW!

Affordable DX-ing!

TS-140S

HF transceiver with general coverage receiver.

Compact, easy-to-use, full of operating enhancements, and feature packed. These words describe the new TS-140S HF transceiver. Setting the pace once again, Kenwood introduces new innovations in the world of "look-alike" transceivers!

- **Covers all HF Amateur bands with 100 W output.** General coverage receiver tunes from 50 kHz to 35 MHz. *(Receiver specifications guaranteed from 500 kHz to 30 MHz.)* Modifiable for HF MARS operation. *(Permit required).*
- **All modes built-in.** LSB, USB, CW, FM and AM.
- **Superior receiver dynamic range** Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range.

- **New Feature! Programmable band marker.** Useful for staying within the limits of your ham license. For contesters, program in the suggested frequencies to prevent QRM to non-participants.
- **Famous Kenwood interference reducing circuits.** IF shift, dual noise blankers, RIT, RF attenuator, selectable AGC, and FM squelch.

- **M. CH/VFO CH sub-dial.** 10 kHz step tuning for quick QSY at VFO mode, and UP/DOWN memory channel for easy operation.
- **Selectable full (QSK) or semi break-in CW.**
- **31 memory channels.** Store frequency, mode and CW wide/narrow selection. Split frequencies may be stored in 10 channels for repeater operation.
- **RF power output control.**
- **AMTOR/PACKET compatible!**
- **Built-in VOX circuit.**
- **MC-43S UP/DOWN mic. included.**

Optional Accessories:

• **AT-130** compact antenna tuner • **AT-250** automatic antenna tuner • **HS-5/HS-6/HS-7** headphones • **IF-232C/IF-10C** computer interface • **MA-5/VP-1** HF mobile antenna (5 bands) • **MB-430** mobile bracket • **MC-43S** extra UP/DOWN hand mic. • **MC-55** (8-pin) goose neck mobile mic. • **MC-60A/MC-80/MC-85** disk mics. • **PG-2S** extra DC cable • **PS-430** power supply • **SP-40/SP-50B** mobile speakers • **SP-430** external speaker • **SW-100A/SW-200A/SW-2000** SWR/power meters • **TL-922A** 2 kW PEP linear amplifier (not for CW QSK) • **TU-8** CTCSS tone unit • **YG-455C-1** 500 Hz deluxe CW filter, **YK-455C-1** New 500 Hz CW filter.

TS-680S

All-mode multi-bander

- 6m (50-54 MHz) 10 W output plus all HF Amateur bands (100 W output).
- Extended 6m receiver frequency range 45 MHz to 60 MHz. Specs. guaranteed from 50 to 54 MHz.
- Same functions of the TS-140S except optional VOX (VOX-4 required for VOX operation).
- Preamplifier for 6 and 10 meter band.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
2201 E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

QRX . . .

to something more substantial. 4Z4QZ will continue in his position as the repeater's Technical Custodian. This brings to nine the number of FM repeaters operating on two meters in this tiny Middle Eastern nation. The Young Generation Repeater operates on 145.375 MHz following the IARU Region I (European) Bandplan.

Japan: The Japan Amateur Radio League (JARL) is sponsoring two major operating events this year. Special Events station 8J1YES at the Yokohama Exotic Showcase is operating on 1.8 MHz–1.2 GHz through October 1, on all modes. 8J6APX will be on the air through September 3 on 3.5–50 MHz, operating CW/SSB/Packet in celebration of Fukuoka '89, the Asian-Pacific Exposition.

Soviet Union: A new English-language amateur radio magazine is now available by direct subscription from the USSR. *Infotech Ham Magazine* contains such topics as Soviet DX News, Ham-to-Ham visits, technical topics, including VHF/UHF, news about happenings in Soviet radio clubs, and a ham equipment marketplace. Subscription brings with it automatic membership in the Infotech Amateur Radio Club International. Subscription is $36 US via airmail. Payment must be made to Acct. No. 61901005, VNESHBANK SSSR, Minsk Belbyttehnika. For further information write to *Infotech Magazine,* PO Box 41, Minsk, 220050, USSR.

The crew of the St. Peter's (Missouri) ARC at their October '88 meeting. The evening's program was "How to Reduce Repeat TVI Complaints," given by W@OGS (the carrot). After a visit from this bunch, would you complain again?

Tornados

Alabama hams taking part in Emergency Net X-Ray won't soon forget the first weekend of March. As severe weather pounded the state, 170 hams spent over 30 hours handling priority messages. While the weather bureau issued scores of tornado warnings and amateurs assisted with emergency communications, two twisters struck a town just east of Birmingham. Amateurs remained on duty at the National Weather Service until Sunday evening. Good work!

Not Just Another Fish Tale

A recent issue of the journal *Nature* describes the work of scientists at the Scripps Oceanographic Institute in California on the electric fish *Eigenmannia*. These fish emit electrical discharges in the 300–500 Hz range from an organ on their tails, to detect friend and foe.

Imagine the mutual interference when two or more of these fish gather! Fortunately, these fish have developed a very sensitive jam-avoidance system. Using electrical detectors all along its body which compare signals from its own electric organ with those from nearby transmitters, the fish determines whether the jamming signal is at a higher or lower frequency than its own. When the fish figure this out, the one with the higher frequency rapidly moves up a few Hertz, and the one with the lower frequency moves down a few Hertz.

It's interesting to note that these electric fish automatically do as hams do—QSY off the QRM. Perhaps the ham equipment manufacturers or an enterprising home-brewer will take a cue from this curious creature!

Young Hams' Net

The North American Youth Net is a newly formed voice net for young amateurs to meet with hams of similar age. It meets on Saturday evenings, 2300 GMT (1900 EST) on 28.450 MHz. This allows young US hams of all license levels to check in. Ten meters has lately been open at that hour in the US.

Ham Prodigies

Sandi KC4AJO, meet Nathan KG5RC/AE. The March 1989 "QRX" column reported that Sandi was probably the youngest Extra Class licensee—she attained this highest level ticket at age 10 years, three months. Her record was edged, however, by Nathan T. Moore KG5RC/AE, ex: N5KSF, ex: KA5YCA, who turned 10 on October 7, 1988, and passed his Extra exam on New Year's Day 1989. Age when he became Extra Class: 10 years, 2 months, and 3 weeks.

Nathan passed his Novice when he was 6, his Tech at age 8, and his General at age 9. He passed his advanced on December 17, 1988, and his Extra only two weeks later.

Congratulations to these two exceptional members of our fraternity.

Next?

Uniden Mod Revisited

There are several updates and corrections to the Uniden HR-2510 modification article that appears on pages 34–35 of the April '89 issue. Radio Shack discontinued the DPDT DIP relay, part #275-213A—replace it with the Potter and Brumfield part #T85N11D114-12. The reference on page 35 concerning R39, a 2.2k resistor, is Photo A instead of Photo D. Finally, in the sentence following the last reference, change "R1/R2/C1" to "R1/R2/C2."

You may reach Uniden's Parts Department at 9900 West Pointe Dr., PO Box 50463, Indianapolis IN 46250. Tel: (317) 842-1036.

Need Manuals?

A good source of manuals for old equipment is Hi-Inc., PO Box 864, 1601 Ave. D, Council Bluffs, IA 51501. They carry manuals for most National, Hallicrafter, Hammarlund, and other rigs of similar vintage.

Errata

Please note the following items to correct:

February '89 issue, TS-940 review. The line,"250 Watts PEP output power" should read "250 Watts input power."

April '89 issue, "Aerial View." There are several errors in the BASIC program. Note the corrections in the next "Aerial View."

A Big Hand To . . .

. . . all those who contributed to this month's QRX column. They are: *Westlink Report, Ground Wave, BNT Bulletin, W4CA Log, LCARA Patch, ANARC, Milliwatt, QRZ,* Bob Newkirk, Tselil Harmoni, K6DUE, NT2X, ARRL, JARL, CARF, KB4KCH, WB9WDH, WA9QDZ, and NX5Z. Keep those photos and news items rolling in to *73 Magazine*, Forest Rd., Hancock NH 03449. Attn: QRX.

Spread-Spectrum

A fascinating mode—and legal for hams to use!

by André Kesteloot N4ICK

First, a trivia quiz for World War II buffs:

Question: What did movie star Hedy Lamarr in Hollywood and German General Rommel in Libya have in common?

Answer: Spread-spectrum! General Rommel used a spread-spectrum (SS) communication link between Germany and Derna, Libya; and in 1941 actress Hedy Lamarr obtained one of the original patents in the US on frequency-hopping spread-spectrum.[1]

If nothing else, the above should tell you that spread- spectrum is not new by any stretch of the imagination. Why is it, then, that 48 years after the beginning of World War II, spread-spectrum still evokes in many the idea of stealth and secrecy, rather than spectrum management?

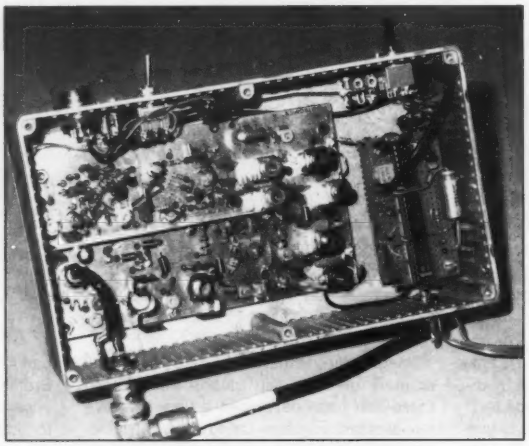


Photo A. An SS transmitter. A modified Hamtronics 440 MHz exciter drives a final amplifier (not shown in photo). The board to the right includes a pseudo-noise generator and pre-scaler divider chain.

The Spread-Spectrum Transmission

To qualify as "spread-spectrum," a transmission must meet the following criteria: (a) the bandwidth must be independent of the modulating signal; (b) the bandwidth must be much larger than those for traditional modulation schemes; and (c) data recovery must be achieved by synchronizing a code at the receiver end of the link.

Although there are many types of spread-spectrum modulation schemes, only two are authorized by the FCC for radio amateurs: frequency-hopping (FH) and direct-sequence (DS).

Frequency-Hopping

In frequency-hopping, the transmitter transmits for a short time on frequency F1, then hops to frequency F2, then F3, etc. Although the hopping pattern appears to be random, it is in fact predetermined (pseudo-random). Communication can only take place if the receiver knows the hopping sequence and synchronizes its hopping to the transmitter's.

If we take, for instance, a hopping sequence of 127 discrete frequencies, and we are faced with interference on discrete frequencies F3, F16, and F57, reliable transmission of information will still take place 124/127 of the time. Because of the redundancy in human speech, this system should be particularly attractive to those operating in heavy interference.

Direct-Sequence

In direct sequence, generally a carrier (say 446 MHz) is mixed in a doubly-balanced mixer with a pseudo-random sequence (clocked at, say, 2.78 MHz). In the process, the carrier will be canceled and replaced with a noise-like spectrum of a bandwidth several Hz above and below the original carrier.

Of the energy transmitted, however, 90% will be concentrated in a band between 443.12 MHz (446−2.78) and 448.78 MHz (446 + 2.78) in this example. At the receiver end, only a minor rise in the noise-floor will appear around your frequency (see Figure 1), but after successful despreading, the original carrier will be recovered (see Figure 2).

Advantages and Difficulties

Some of the advantages of spread-spectrum are:

Better frequency spectrum utilization. Since a non-correlated receiver hears nothing

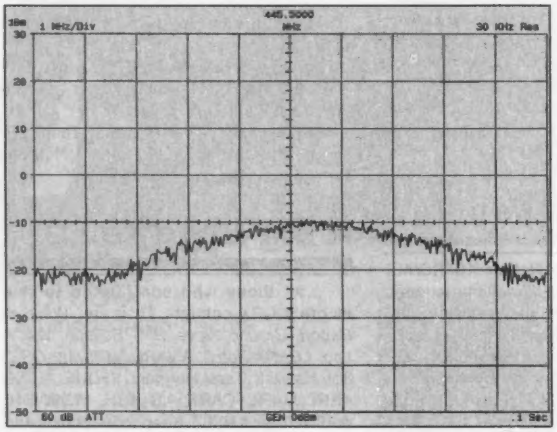


Figure 1. A Direct Sequence (DS) spread-spectrum signal, reception. Only a minor rise in the noise-floor will appear around your frequency.

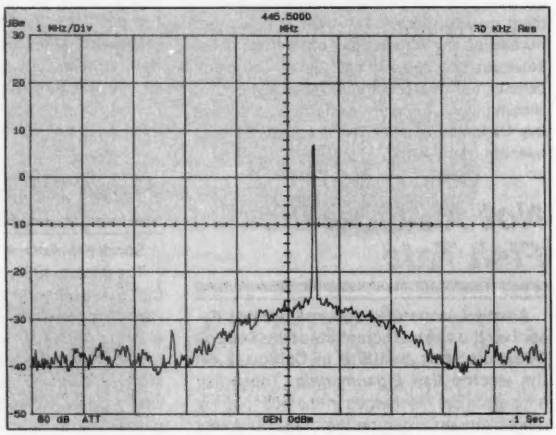


Figure 2. The recovered signal after successful de-spreading.

Photo B. An SS receiver. It is a doubly-balanced enclosure, where a locally-generated PN signal mixes with the incoming RF signal from the preamplifier. Note the strip-line construction, and the two MMICs, clearly visible near the two BNC connectors on the left and right of the photograph.

but noise, you can allow multiple transmissions on the same frequency band, with several transmitters literally on top of each other.

Secure communications. Depending on the sophistication of the pseudo-noise code, unauthorized parties may find it very difficult to recover the original modulation.

The ability to reject interference. Unless the interference is actually synchronized onto the transmitted information, it will not appear at the receiver output. Spread spectrum transmissions are thus inherently more resistant to interferences.

In both cases FH and DS, the most difficult process to control is synchronization between transmitters and receivers. More time, more money, and more energy have been spent on that problem than on any other spread-spectrum problem.[2] How do you synchronize on a signal which you can neither see nor hear?

In addition, spread-spectrum has not been used much outside of the military (and, more recently, space communications) because the circuitry is complex and the cost is high. The latter has helped keep frequency-hopping and direct-sequence either in the classified or proprietary domains.

A simple, albeit slow, synchronization system for amateur radio purposes, designed by the author, appears in the 1989 *ARRL Handbook*, Chapter 21, page 15.

Neither would be difficult to "break" if we were interested in secret/secure radio communications, but as amateur radio operators, by definition we are not. However, this explains why one of the major advantages of spread-spectrum for the military (low probability of intercept) directly translates in the radio-amateur world as low probability of interference.

An Invitation to Discovery

Incidentally, neither of the systems mentioned above uses hard-to-find or expensive parts. You can generate pseudo-random noise with shift-registers. You can construct simple ones with as little as two ICs (74164 and 7486, for instance), while doubly balanced-mixers are readily available for about $5. This is an undisguised invitation for you to try your hand at spread-spectrum experimenting!

But, you will say, why bother with spread-spectrum in the first place? For one thing, because of the spectrum utilization problems we are all facing. We all want to squeeze more and more transmissions into well-defined bands, and something will have to give. With spread-spectrum, you can get additional frequency utilization.

Another fascinating angle of this technology, surely, is that there is still so much to discover, improve upon, and develop in spread-spectrum. This would be a fabulous way to put our virtually unused microwave bands to good use—there, in spread-spectrum, you could try all sorts of new modulation schemes! High speed data transmissions and spread-spectrum television come readily to mind.

If this article has been able to whet your appetite to learn more on the subject, the references mentioned below and the *ARRL Handbook* are a good place to start.

AMRAD, the nonprofit Amateur Radio Research and Development Corporation, has been experimenting with amateur spread-spectrum since 1980. If interested, write to *AMRAD, PO Box 6148, McLean, Virginia 22106-6148.* ■

References

[1]R. Scholtz, "The Origins of Spread-Spectrum Communications," *Spread-Spectrum Communications*, p. 7. New York: IEEE Press, 1983. R. Price, "Further Notes and Anecdotes on Spread-Spectrum Origins," ibid., p. 41.

[2]R. Dixon, *Spread Spectrum Systems*, p. 214. New York: John Wiley & Sons, 2nd Edition, 1984.

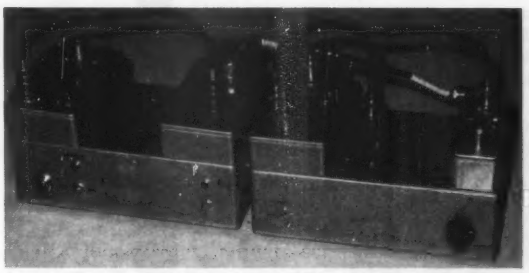
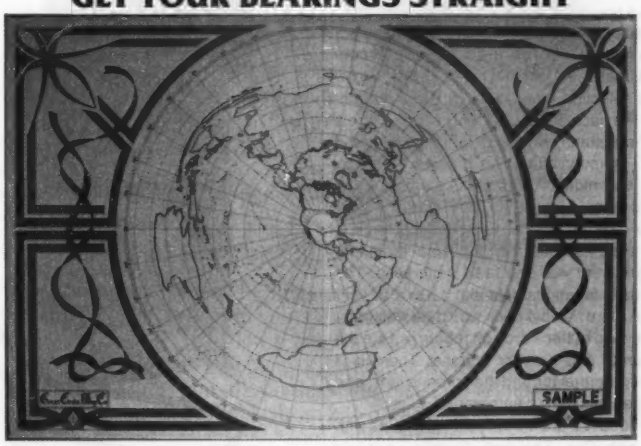


Photo C. Complete 440 MHz direct-sequence amateur spread-spectrum setup. The transmitter is on the left; the receiver on the right. Die cast aluminum boxes provide mechanical rigidity and shielding.

GET YOUR BEARINGS STRAIGHT



At last! A map dedicated to the radio amateur. Announcing the **Azimuth-Equidistant** wall map from the Great Circle Map Co.

An azimuth map provides information about heading and range to any place on Earth. No longer will you have to guess at which way to aim your beam antenna for that rare DX.

Each map is specially drawn with your station at the exact center. The rest of the world is spread out around you. To use the map, simply find the target station and read the compass heading from the border of the map. To find the range, count the number of rings from the center. Each ring is spaced 1000 miles apart. Voila! You now know the true heading and range to the target station.

The maps are custom drawn with computer accuracy for your location and are personalized with your station's call sign at the lower right. Each map measures 35"x23", is brightly colored, and is printed on high quality poster stock making it suitable for framing.

To order, send $39 check or money order and your station's call sign and location (if you live in a large city, state which side of town) to:

Great Circle Map Co.
P.O. Box 691401 • San Antonio, TX 78269

DEALER INQUIRIES INVITED

CIRCLE 346 ON READER SERVICE CARD

73 Review *by Michael J. Geier KB1UM*

Yaesu FT-411 FM HT

Ever smaller and fuller featured . . .

Yaesu USA
17210 Edwards Rd.
Cerritos, CA 90701
(213) 404-2700
Price Class: $350

Yaesu has a long tradition of innovation in HTs. From the first digital-display, microprocessor-controlled walkie (the FT-207R) to the first dualbander (the FT-727R), they've led the way, defining the new frontier. This tradition continues with the introduction of the FT-411.

The 411 is part evolution, part revolution. It packs into a shirt-pocket-sized radio all the features of the larger rigs and adds some terrific abilities never before seen.

Basics

Receive frequency coverage is from 130–174 MHz, and transmit is from 140–150. There are 49 memories (actually 50, if you count the second VFO), and each one can hold everything from CTCSS tone and status to separate RX and TX frequencies, for odd split operation. By the way, the CTCSS encode/decode unit is a standard feature, included in the price and factory installed. (I hope other manufacturers follow suit.) The 16-button keypad controls almost all functions, including HIGH/LOW power selection. There are no hidden switches on the back. In fact, the only other controls are the volume, squelch, tuning knob, and "call" memory button on top, and the PTT, lamp, and monitor on the side, where you'd expect them.

The radio is small and light. The back is metal alloy and the front is plastic. It fits into my hand very well and feels quite solid. The antenna is fat and substantial but is also very rigid. A more flexible duck would be welcome. The keypad buttons are soft rubber, as are the PTT, lamp, and monitor buttons. There is a rubber grommet around the antenna jack, and the rig seems fairly weatherproof.

Included is a 600 mAh NiCd battery, as with most new rigs. The wall charger connects through a small jack on the back, and you can operate the rig while the battery charges. Of course, with a very depleted battery, it may not operate too well, especially on transmit. For receiving, it works fine, as long as the battery has some charge on it. The FT-411 uses the same batteries as the FT-23R series, and optional batteries for higher power or longer operating time, as well as AA and AAA packs, are available.

Features Galore

Where do I begin? This rig has every feature

I've ever seen, and a few new ones. Frequencies may be entered in several ways. You may use the tuning knob, the UP/DOWN arrow keys, or you may key in the frequency directly from the keypad (my favorite method). When using the knob or arrow keys, a press of the FUNCTION key makes them step the VFO in 1 MHz steps. I should say VFOs, because there are two of them! Emulating modern HF rigs, VFOs A and B are identical in function and can be toggled between with a press of the VFO button.

Operating data is displayed on a front-mounted LCD, showing frequency, memory channel number, VFO A or B, and a host of other things. The display can be backlit by pressing the lamp button, above the PTT switch. The keypad lights up at the same time, making night operation very convenient. LEDs are used for the keypad, but the LCD is lit with an incandescent lamp, something I'd hoped we'd seen the last of. It is very bright, though, and makes the LCD easy to read. The lamp has no timer; you must keep the button pressed as long as you need it, so two hands are required.

Band and memory scan are provided, along with two special-purpose memories used to set upper- and lower-band scanning limits. You can set the scanner to pause for five seconds on each busy channel (great for public service band scanning) or to wait until the carrier drops, which I prefer for ham repeater use. The scan is very fast, about 14 VFO steps or memory channels per second. It really zips through the band.

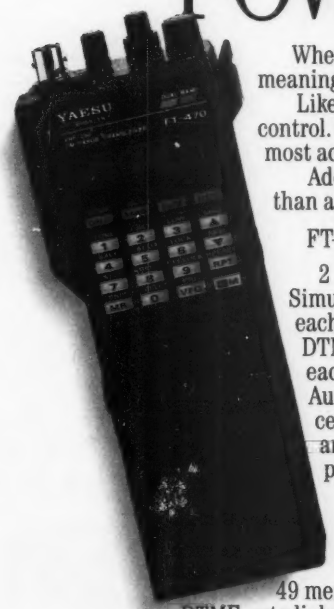
There are 48 general-purpose memories, and one "call" memory. It behaves like all the other ones but is selected via a top-mounted button. It's very handy for hamfests and simplex use or can be programmed with your favorite repeater frequency, for quick access.

Memories may be locked out in two ways. SKIP hides the memory channel from the scan, but it's still there for manual selection (Yay!). It's great for the NOAA weather channel, or a very busy repeater. HIDE erases a memory completely, except that you can "unhide" it later and get it back. I find this feature to be especially useful for travel. I often commute between three cities, so I put the repeaters for each into banks of ten. I lock out Boston and Miami (using HIDE) when I'm home in Vermont, and then unhide them when I go. Each memory channel must be hid and retrieved separately. It would have been nice if there were some way to manipulate whole ranges (such as 10–19) at a time, but it still beats having to re-enter all those frequencies.

The memories normally act as fixed frequencies, but a press of the MR button makes any memory into a tunable VFO! It will even scan up or down the band from the memory. After arriving at a new frequency, you can store it in any memory channel or a VFO, or simply return to your original memory channel, disturbing nothing.

Continued on page 18

OUR COMPLETE LINE OF PORTABLE POWER TOOLS.



When you're talking Yaesu handhelds, power takes on many meanings.

Like maximum RF output. Sophisticated microprocessor control. Deceptively simple operation. Even cost savings—as most accessories are interchangeable throughout the line.

Added up, it's no wonder amateurs choose Yaesu HTs more than any others.

FT-470. DUAL-BAND OPERATION PERFECTED.

2 meter and 430-450 MHz. 42 memories. Simultaneous receive of both bands. Dual VFOs each band. PL encode/decode. Paging feature. DTMF autodialer (10 memories, 15 digits each). Auto repeater shift. Scanning features. Auto power-off. Battery saver. Extended receive. Audible command verification. Keypad and rotary-dial frequency entry. Battery packs available from 2.3 to 5 watts. More.

FT-411 SERIES. MAXIMUM SINGLEBAND PERFORMANCE.

2-meter FT-411 and 440-MHz FT-811. 49 memories. Dual VFOs. PL encode/decode. DTMF autodialer (10 memories, 15 digits each). Auto repeater shift. Scanning features. Auto power-off. Battery saver. Extended receive. Audible command verification. Keypad and rotary-dial frequency entry. Many battery packs available, from 2.3 to 5 watts. More.

FT-23R SERIES. SMALL, SMART, RUGGED.

2-meter FT-23R, 220-MHz FT-33R, and 440-MHz FT-73R. 10 memories (7 store odd splits). Memory scan at 2 frequencies per second. High/low power switch. LCD power output and "S"-meter display. Many PL features. Auto-battery saver. Aluminum-alloy case. Water-resistant seals. Many battery packs available, from 2 to 5 watts. More.

Want more information? Call **(800) 999-2070** toll-free. Or ask your dealer about Yaesu's FT-470, FT-411 and FT-23R Series handhelds. The power in handheld performance.

YAESU USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **REPAIR SERVICE:** (213) 404-4884. **PARTS:** (213) 404-4847

YAESU

Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. Specifications guaranteed only within amateur bands.

rfe

hy-gain antennas & towers

Tribanders

TH7DXS Explorer-14 TH5MkIIS

Monobanders

204BAS 203BAS 205BAS
155BAS 153BAS 105BAS
103BAS 64BS 66BS

VHF, OSCAR, & VERTICALS

CALL US FOR HY-GAIN EQUIPMENT!

TOWERS

Crank-up, self-supporting, galvanized steel towers.
"SS" series rated at 9 ft^2; "HD" series rated at 16 ft^2.

HG-37SS HG-52SS
HG-54HD CALL FOR PRICES! HG-70HD

ANTENNAS

CUSHCRAFT:

Tribander Special! A3S & A4S.....$259.95 / $339.95
A743 & A744 30/40 meter add-on kits available.
Verticals: AV3, AV5, and the new R4 and APR8
Monobanders: For 10, 12, 15, 20, and 40 meters.
VHF & UHF: Antennas for FM; SSB & CW, OSCAR.
617-6B, A50-6, & A50-5 for 6 Meter Openings!
4218XL &3219 for 2 Meter DXing.
Additional **Boomers** for 220 and 432 MHz.
OSCAR & ATV antennas.

If you need a CUSHCRAFT antenna, we can supply it!

KLM World Class Antennas.

KT34A.....$395.00 KT34XA.....$585.00
VHF,UHF, & OSCAR Antennas.
We stock KLM HF Monobanders!

BUTTERNUT

HF6V Vertical HF2V Vertical
RMK II roof mount kit, STR II radial kit,
WARC resonators, & TBR-160 coils.
HF5B Compact Beam.

ALPHA DELTA

DX-A.. ..$46.95 DX-DD...64.95 DX-KT...$27.50
DX-CC...$79.95 Switches & Transi-traps in stock!

HUSTLER:

6BTV, 5BTV, G6-144B, G7-144, G7-220

Complete mobile systems. CALL!

MOSLEY: Specials on TA-33, TA-34, CL-33, Pro-67!

ROTORS

TELEX/hy-gain

HDR-300
T2X
HAM IV
CD 45 II

YAESU

G400/400RC
G600RC
G5400B

ALLIANCE

HD-73 U-110

TOWERS

ROHN

Self-supporting: Rated (ft^2): HDBX=18; HBX=10; BX=6
Galvanized steel **with** base and rotor plate.
Todays best tower buy! Freight additional but you save with our volume shipper's discount!

HBX40.....$249.95 HDBX40.....$315.00
HBX48.....$339.00 HDBX48.....$424.00
HBX56.....$435.00 BX64.....$469.00

Guyed tower sections: Complete packages & components
Sections:25G..$59.00 45G..$139.00 55G..$179.00

Call us for all your ROHN requirements!

Fold-over towers:

FK2548.....$1125.00 FK4544.....$1485.00
FK2558.....$1195.00 FK4554.....$1595.00
FK2568.....$1235.00 FK4564.....$1695.00

Prices 10% higher in western states.

Tower Hardware:

Guywire: 3/16EHS / 1/4EHS.....$0.15/0.18
CCM Cable Clamps: 3/16 / 1/4.....$0.39/0.49
Turnbuckles: 3/8"E&E & E&J.....$6.95/7.95
1/2"E&E & E&J.....$12.95/13.95
Preformed "Big Grips" 3/16&1/4.....$2.49/2.99
Guy Insulators: 500D / 502.....$1.69/2.99

Phillystran Guy Systems:

HPTG-2100 / -4000 / -6700 Cable....$0.30 / 0.50 / 0.70 /ft.
Cable ends and potting compound in stock.

WIRE & CABLE

BELDEN COAX:

9913 Low loss .....$0.47/ft. RG-8X(9258).....$0.22/ft
RG-213/U(8267).....0.48 RG-11A/U(8261)....0.43
RG-8/U(8237).....0.38 RG-58A/U(8259)....0.17
RG-8/U(8214).....0.42 RG-50/U(8241).....0.18
RG-214/U(8268).....$2.30/ft

COPPERWELD ANTENNA WIRE:

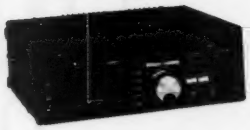
Solid: 12 ga...0.12; 14 ga...0.09; Stranded 14 ga...0.10/ft.

ROTOR CABLE:

Std.(6-22, 2-18)...$0.21 Hvy Dty(6-18,2-16)...$0.38/ft.

We stock Andrew Heliax & Connectors.
Full line of Amphenol connectors.

YAESU

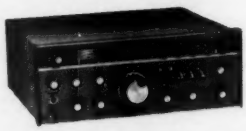


736R VHF-UHF TRANSCEIVER

The new standard in VHF-UHF performance.
Call us for all YAESU equipment:
HF TRANSCEIVERS MOBILE UNITS
HANDHELDS AMPLIFIERS

YES! WE STOCK ACCESSORIES.

TEN -TEC



MODEL 561 CORSAIR II

OTHER TEN-TEC PRODUCTS:

Model 585 Paragon
Model 425 Titan Linear Amplifier
Model 229B Antenna Tuner

Mobile Antennas! Metal Project Boxes.

AMPLIFIERS & TUNERS

AMERITRON **MIRAGE**

NYE -VIKING MB-V-A

rf concepts **AMP SUPPLY**

MFJ 989C

ASTRON SUPPLIES

RS-4A.....$ 39.95 RS-7A.....$ 49.95 RS-12A....$ 69.95
RS-20A..... 88.95 RS-35A.....139.95 RS-50A.....199.95
RS-20M....109.95 RS-35M.....159.95 RS-50M.....219.95
VS-20M....124.95 VS-35M.....174.95 VS-50M.....232.95

NEW! RFE is now stocking IIX Equipment

ALINCO-AMERITRON-AMP SUPPLY-ANTENNA SPECIALISTS-ASTATIC-BENCHER-B&W-CREATE-DAIWA KANTRONICS-LARSEN-MFJ-MOSLEY-PALOMAR-SANTEC-SHURE-TONNA-WELZ-AND MORE

CIRCLE 16 ON READER SERVICE CARD

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback#	Title
1	Welcome Newcomers
2	Never Say Die
3	QRX
4	Spread-Spectrum
5	Review: Yaesu FT-411
6	Home-brew: QRP CW Transceiver
7	Home-brew: G3IGU Transceiver
8	Review: Ranger AR-3500
9	Net/ROM-NordLink Question
10	Review: Portasol Butane Soldering Pencil
11	Home-brew: 220 MHz PA, Part II
12	Review: MFJ Differential "T" Tuner
13	Home-brew: QRP SWR Bridge
15	Home-brew: Six Meter QRP Station
16	Ham Help
17	Review: Antennas West Solar Power Supply
18	Decoding OSCAR Telemetry, Part II
19	Circuits
20	Home-brew: CW Transceiver for 20 Meters
21	Above and Beyond
22	Index 6/89
23	RTTY Loop
24	Ask Kaboom
25	QRP
26	New Products
27	Ad Index
28	Looking West
29	Review: Wilson 1000 Mobile Antenna
30	Letters
31	73 International
32	DX
33	Special Events
34	Dealer Directory
35	Barter 'n' Buy
36	Propagation

New from AOR

2000 Channels 5MHz to 1500MHz

AR2515

- Covers 5MHz to 1500MHz in AM/FM/Wide FM modes. Continuous coverage.
- 2000 Channel Memory. 1984 Scan Frequencies & 16 Search Groups.
- Scan/Search speeds up to 36 channels or increments per second.
- Built in RS 232 computer interface.
- 25 Day Satisfaction Guarantee. Full Refund if not Satisfied.
- Size: 3½"H x 5⅝"W x 7⅛"D. Wt.: 2 lb. 10 oz.
- Supplied with AC & DC power cords. Telescopic antenna.

Total Price. Freight Prepaid (Express Shipping Optional) *Upgrades of AR2002's to AR2515 specs Available

$695.00

ACE COMMUNICATIONS
10707 E. 106th St. Indpls., IN 46256
Toll Free 800-445-7717
Visa and MasterCard
(COD slightly higher)
In Indiana 317-849-2570 Collect FAX (317) 849-8794

CIRCLE 355 ON READER SERVICE CARD

Aries—1
Amateur Radio Integrated Entry System

MULTI FUNCTION

SOFTWARE

FOR IBM PC/XT/AT PS/2 & COMPATIBLES - $89.95 -

- Automatically inserts into log: Computer DATE / TIME - Transceiver FREQUENCY / MODE (current Kenwood and Icom models).
- Is both a Logging and a Terminal program
- No other software needed
- Interfaces with Kantronics KAM, and AEA PK-232
- Works with a Mouse and/or Function Keys
- Fast and easy control of Terminal Units and Data Entry.
- Contest Mode and auto string replacement
- Extremely fast Voice or Digital mode exchanges.
- Automatic Dup checking
- Search / print by Call, Country, Freq, QSL info, etc.
- QSL label printing
- Lets you run other programs (or access DOS) while staying resident in memory along with your data.
- Allows for example, logging while simultaneously connected to a packet mail box and down-loading messages into a capture file.

An Extremely useful program! Most Aries-1 Users "fire up" the program whenever they are in the shack. Whether operating Voice AMTOR, Packet or any other mode, you will enjoy having your log available on screen simultaneously with your Terminal Unit and access to your other ham software just a keypress away.

VISA -- Our 10th Year of delivering Quality Software to the International market -- MasterCard

ashton ITC
PO Box 1067 - Vestal, NY 13851 - (607-748-9028)

CIRCLE 338 ON READER SERVICE CARD

THE SOTRON
ANTENNAS FROM 160–10 METERS
NEW LOCATION
NO TUNERS!
NO RADIALS!
NO RESISTORS!
NO COMPROMISE!

THREE EXCELLENT REVIEWS JUST DON'T HAPPEN BY CHANCE.
CALL US FOR A FREE CATALOG
• See review in Oct 73, 1984 • Sept 73, 1985 • March 73, 1986

BILAL COMPANY
137 Manchester Dr.
Florissant, CO 80816 PH: 719-687-0650

CIRCLE 42 ON READER SERVICE CARD

Field Day Solar Power

The $289.95 Bullet-Tested QRV Solar Power Supply keeps your repeater on the air 'round the clock or powers your 100w HF station 60 hrs a month. Control circuit speeds charge, protects gel cells & sealed batteries. Fully assembled. QRV, portable. Easily expanded.
Add $10 S&H Info $1
(801)373-8425 AntennasWest Box 50062-S Provo UT 84605

CIRCLE 236 ON READER SERVICE CARD

Continued from page 14

The priority watch function can sample any memory channel. It can also step through the memory channels, incrementing once each sample. It'll even do all this while you're scanning through the band!

All in all, the memory management features of the FT-411 are the most flexible I've ever seen, and the operations are surprisingly easy to do.

. . . And More Features

Battery saver and "Auto Power Off" (APO) functions are both programmable and defeatable. The saver can be programmed from 0 to 1 second "sleep" time between channel checks, and the APO can be set for 10, 20, or 30 minutes, or infinity. Being able to shut the battery saver off makes the rig usable for packet operation, as no packets will get lost while the receiver is asleep. A longer APO time of, say, one hour, would have been nice.

VOX circuitry is built in, and HIGH or LOW sensitivity can be selected. Use of this feature requires an optional headset. CTCSS tones are selected via the tuning knob and are shown on the LCD. The keypad and PTT may be locked, preventing accidental changes or transmission. Both the standard repeater offset and VFO steps are selectable. Automatic offset selection, per the band plan, is provided and can be both overridden and defeated. Finally, a "bell" feature signals you when a station sending your selected CTCSS tone is received, whether you're in CTCSS or not.

Autodialer

This radio has a ten-number DTMF autodialer! It stores numbers of up to 15 digits each, sending them at the touch of a button. If you're a control op or use an autopatch, it's just great. The procedure for entering numbers is a bit cryptic and could have been done better, but it's worth getting the hang of it. Especially for portable operation, this is one feature that will make you wonder how you ever got along without it. Of course, DTMF may also be manually sent.

Documentation

With all these features, some good instructions are in order, and they are provided. The book is written in clear English and takes you easily through the operations. Also, a wallet-sized "crib card" set is provided.

Comparisons

I couldn't help but compare the 411 to my Kenwood TH-25AT, a rig I just recently reviewed. Here are some observations:

Mechanical: The Yaesu is slightly smaller and noticeably lighter than the Kenwood. I find the front-mounted LCD easier to use, though the top-mounted one on the Kenwood is better protected from scratches. Both rigs feel good and solid.

Features: The Yaesu does everything the 25AT does, and lots more. Unique 411 features include 49 memories, direct frequency entry, and autodialer.

Transmitter: Audio reports indicate that the Kenwood is "bassier" but more natural, while the Yaesu is punchier and more "communications" styled. Output power in the HIGH position is the same, but the Kenwood seems a bit stronger in the LOW position. There is no mention in the Yaesu specs of the output in the LOW position.

Receiver: The Yaesu has wider coverage, and selectivity is better. The Kenwood, with one of the "hottest" receivers I've ever seen, makes clear audio from signals the 411 doesn't even hear. But comparison with other rigs show the Yaesu to be about average, and certainly adequate—any repeater you can hit, you can receive.

"This radio has a ten-number DTMF autodialer!"

The Kaboom Audio Enhancer

My principal complaint about this radio is that the audio output power is just too small. In addition, the FT-411's speaker has a tinny, fuzzy quality. There's an easy way, however, to improve this.

A big part of the audio problem is acoustical. The interaction of the speaker with the size and depth of the grille greatly affects the volume and sound quality. Deliberately blocking part of the speaker causes a significant increase in volume, along with a reduction in fuzziness. The improvement is caused by the creation of a resonant chamber between the speaker and the grille front.

Go to an art store and get a clear adhesive plastic film with paper backing. If you can't find this, substitute with wide adhesive tape, as long as it is fairly thick. Cut out a piece 1" wide by 13/16" long. Cut out from the 1" wide piece a center piece 3/16" wide by 5/16" long.

If you hold the rig so that you're looking into the grille from the bottom, you can see the slot for the microphone in the upper left corner, and also the vertical center post in front of the speaker. Wipe the grille with a tissue, peel off the paper backing from the back of the plastic film, and paste the film onto the rig with the top edge centered over the top horizontal slot, and the hole centered over the vertical post. The left edge of the film should just clear the right side of the mike slot. Exact placement isn't critical. Finally, using your fingernail, bend the edges of the film into the top and bottom slots.

That's it—the radio will now sound a whole lot better and you haven't even voided your warranty!

Nit-Picks

The manual, while easy to read, omits a great deal. Although a full schematic is provided, audio output and TX current drain specs are given at 12 volts, so I have no idea what they are with normal 7.2-volt battery use (they should be a lot less). No mention is made of the lithium battery, nor of how to wire a microphone for the rig. You can review the contents of an autodialer memory using the arrow keys, but the subject isn't mentioned in the book; I discovered it by accident.

There are a few birdies in the receiver, well outside the ham bands, but this seems to be typical of wide-coverage rigs and isn't a big deal. Also, two strong local signals show up where they shouldn't, and I can't find them on my 25AT. They appear to be images, or some sort of intermod.

The programmable band scanning will not stop at the limits specified in memory if either limit memory is set for SKIP. Thus, those memories will also appear in your normal memory scanning, unless you want to hide or skip them and then retrieve them each time you wish to use the programmable scan feature.

You may find the musical-scale keypad beeper annoying, because of the double beeps and tunes used for the arrow keys and scanning. Luckily, it can be completely turned off.

The Auto Power Off warning beeper only works when the keypad beeper is active. So, if you turn off the keypad sounds, you really can't use the APO function, because it will shut the rig down without any warning. I discovered this while waiting for a call that never came . . .

The icons on the LCD are very tiny and hard to see. You soon begin to recognize them, however, by their positions on the display. Also, the reflector behind the LCD seems set far back, and light entering at an angle causes blurring of the image.

The RF power output display is generated by the micro and is not a measurement of actual output. It reads full scale in HIGH power, and about ⅓ in LOW power, and will show full output even as the battery dies. Since there is already a "low" indicator for low power, this feature is redundant.

Although there is a low battery warning icon, there is no other voltage monitor, so you can't tell the difference between a fully-charged battery and one about to die. That was one nice feature on the TH-25AT.

The keys are tiny and close together, and large fingers may have a hard time pressing them. A still necessary price to pay for having a full-featured rig you can drop in your pocket.

The radio comes with a very nice padded soft case, but no belt hook. The hook costs extra. Also, the case has no loops for belt use.

The battery pack is plastic rather than metal.

As usual, the lithium battery is buried somewhere inside, with no mention of how to change it.

Also as usual, there is no DC input jack. You must buy an adapter which slides on in place of the battery.

Conclusion

This is the most advanced single-band HT available today. Despite the list of nit-picks, its bevy of features makes the FT-411 an outstanding value. If you want a powerhouse of features in your pocket and can live with the low audio output, this is the rig of your dreams.

antenneX

"The mini-magazine for antenna experimenters"

DO YOU —

- Have a lousy mobile signal on all bands?
- Need an inexpensive directional antenna for 10 meters?
- Can't choose between a vertical or horizontal antenna?
- Need a low noise antenna for 160 meters?
- Want to design an antenna but don't want to redo the wheel?
- Need a program for antenna design and antenna plotting?
- Want to find out if someone else has solved your problem?
- Don't know what antenna is best for: hamsats or others?
- Need a disguised mobile antenna for the car?
- Want a cheap automatic antenna coupler for any type rig?
- Just want to learn more about antennas?

THEN YOU MUST SUBSCRIBE TO - *antenneX*

antenneX is a mini-magazine for antenna experimenters from the new ham to the oldtimer. There is something for everyone. From computer-aided design to reference table of dipole measurements to a question and answer column. Everyone will find something of interest!

A one year subscription is only $11.97 for Continental USA and possesions. $17.00 for foreign surface mail.

Send your subscription to:

antenneX

P.O. Box 8995 Dept. 19 Corpus Christi, TX 78412

CIRCLE 82 ON READER SERVICE CARD

"GUARANTEED TO OUTPERFORM"

THE .....OR YOUR MONEY BACK!

HAM 10™ TEN METER HAM ANTENNA

The "HAM 10" ten meter antenna is designed and manufactured by American Antenna, makers of the world famous K40 Antenna. With a power handling capacity of 1500 watts and a band width of 1.5 mhz between 2:1 SWR points the "HAM 10" is the perfect compliment to all single-band ten meter rigs. The stainless steel base of the "HAM 10" is supplied with an adjustable trunk lip mount. Also available is an optional adaptable heavy duty magnamount. For a free brochure, call 1-800-323-6768 in Illinois 1-800-942-8175.

EXCLUSIVE FEATURES:

1. HANDLES UP TO 1500 WATTS!
2. METALPLAS CONSTRUCTION.
3. 30° ROTATION OF BASE.
4. STAINLESS STEEL WHIP AND BASE.
5. MOUNTS ANYWHERE ON ANY VEHICLE!
6. FULLY ASSEMBLED WITH 18' of RG-58 COAX.
7. COMPUTER DESIGNED ISOLATION CHAMBER.

For A Free Brochure, Call:
1 800-323-6768 IN IL. 1 800-942-8175
TLX# 6871370 K40INTL
....(Or Write) **AMERICAN ANTENNA**
1500 EXECUTIVE DR. ELGIN, IL. 60123

Field Day All-Band Antenna

Ready to Use		Full Legal Power
Fastest Install	Tough	No Lossy Traps
Coax Feed	Flexible	Low Noise
3000 V Insul	Kink-Proof	Never Corrodes

QRV-80-10 $49.95 51 ft. long Includes 40-page Tech Manual Infopack $1

QRV-160-10 $59.95 102 ft. long Add $5 Post & Handling

AntennasWest
Box 50062-S, Provo, UT 84605 (801) 373-8425

CIRCLE 302 ON READER SERVICE CARD

NEW ONLINE CALL DIRECTORY

Our new *HAMCALL* service gives you 494,114+ Hams, via your computer. $29.95 per year — unlimited use!

BUCKMASTER PUBLISHING
Mineral, Virginia 23117
703: 894-5777 800: 282-5628

CIRCLE 156 ON READER SERVICE CARD

PORTA-BEAM

Model DL-146

$84.95 (Free shipping)

At last! A completely portable 2 meter three element Delta loop beam. Easy to set up with no small parts to lose. Low VSWR over entire 2 meter band. Gain equivalent to a 4-element Yagi. All elements and feed line with BNC connector store inside a 3 ft boom. An ideal emergency antenna, backpackable (18 oz.), general field use with accessory mast. Money back if not fully satisfied.

MasterCard VISA

P.O. Box 520011-S
Salt Lake City, UT 84152

SUMMITEK
AM (801) 277-4205

NEWS BULLETIN

CALL US NOW!

YOUR HAM DOLLAR GOES FURTHER AT . . .

CALL OR WRITE FOR SPECIAL QUOTE

When it comes to FAST DELIVERY, HONEST DEALING and PROMPT DEPENDABLE S.E.R.V.I.C.E. backup We don't just advertise it — WE GIVE IT

Burghardt AMATEUR CENTER INC.

"AMERICA'S MOST RELIABLE AMATEUR RADIO DEALER"

SELL-TRADE

New & Reconditioned

HAM EQUIPMENT

Call or Write Us Today For a Quote!
You'll Find Us to be Courteous, Knowledgeable and Honest

PHONE (605) 886-7314
FAX (605) 886-3444

we'll treat you

SELECTION
S-E-R-V-I-C-E
and
SATISFACTION!

In 1937, Stan Burghardt (WØIT), because of his intense interest in amateur radio, began selling and servicing amateur radio equipment in conjunction with his radio parts business. We stand proud of this long-lasting tradition of ***Honest Dealing, Quality Products and Dependable "S-E-R-V-I-C-E"!***

Above all, we fully intend to carry on this proud tradition with even more new product lines plus the same ***"fair"*** treatment you've come to rely on. Our reconditioned equipment is of the finest quality with ***30, 60*** and even ***90-day*** parts and labor warranties on selected pieces. ***And always remember:***

STORE HOURS:
9-5 P.M. (CST)
MONDAY thru FRIDAY
OPEN SATURDAYS
from 9-1 P.M. (CST)
CLOSED
SUNDAYS/HOLIDAYS

MasterCard VISA

182 N. Maple
P.O. Box 73
Watertown, SD 57201

— WE SERVICE WHAT WE SELL —

AEA	B&W	Hustler	Nye
Alinco	Belden	Icom	Palomar
Ameco	Bencher	Jerold/Delhi	Radio Callbook
Ameritron	Bird	Kantronics	RF Concepts
Amphenol	Butternut	Kenwood	Rohn
Amp Supply	Centurion	Larsen	Telex/Hygain
Antenna Specialists	CES	MFJ	Ten-Tec
	Cushcraft	Mirage/KLM	Unadilla/Reyco
Astron	Daiwa	Moseley	Yaesu

Write today for our latest Bulletin/Used Equipment List.

IC-781

The Future of Amateur Communications

CALL FOR A QUOTE!

QRP CW Transceiver

A great little do-it-yourself DC rig for the 30 or 40 meter band.

by Bruce Auld NZ5G and Bill Heishman N5HNN

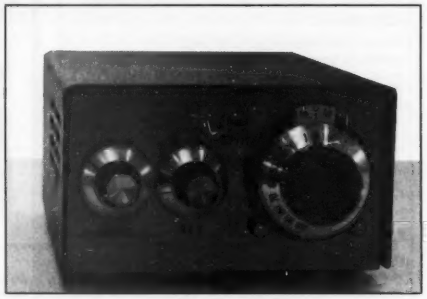


Photo A. Front panel of the QRP transceiver. The Receive Incremental Tuning (RIT) control allows you to adjust the receive frequency without changing your transmit frequency.

Much of the fun in amateur radio comes from having "done it yourself." In my search for a project that would yield a unit with satisfying performance, I found two common problems: The writer assumed too much knowledge on the part of the builder, and the parts were not widely available.

This project is different. The builder gets a running start in home-brew with something that will deliver plenty of fun and performance, and the parts are available to anyone with access to a Radio Shack store.

This is a 3-Watt, single circuit board, 40 or 30 meters, VFO-controlled CW transceiver, featuring a direct conversion receiver with audio filtering, Receiver Incremental Tuning (RIT), and speaker level audio volume. It is based upon the classic design by W7EL with a few alterations. My partner (and technical genius) in this project, Bill Heishman N5HNN, and I put it together as a club project for the Arlington Amateur Radio Club.

Theory of Operation

The direct conversion receiver and transmitter described in this article are quite simple. Much of the technical information you might want to know, and the rationale behind specific design choices, has been expertly described by Roy Lewallen W7EL ("An Optimized QRP Transceiver," *QST*, August 1980).

The best way to get over the initial fright of looking at the schematic diagram is to break the circuit down into modules and see how simply the modules connect to one another. Theoretically, the modules could be built separately and then interconnected with a few cables. For simplicity, all the modules are located on a single board.

Refer to the flowchart and schematic diagram, Figures 1 and 3. Beginning with the transmitter, the transmit frequency is generated by Q1 and its associated components in the VFO. The buffer, Q2, isolates the oscillator from the other circuitry to help keep the VFO stable. Q3 builds up the signal to a more usable level. The driver, Q4, amplifies the signal. The final, Q5, amplifies it to the 3-Watt level.

You key the transmitter by turning the power to the driver on and off, using Q6 as a switching transistor. Select the frequency by varying the tuning capacitor, C2. The transmitter is that simple!

The VFO frequency feeds into the diode-ring mixer, and is mixed with the incoming 7 or 10 MHz signal. The difference, or "product," is the audio frequency you eventually hear from the speaker. That is why this stage is also called a "product detector." All the circuitry after the mixer builds up the audio signal to speaker level: Q8 preamplifies the signal a little, U2 is an audio filter that attenuates the audio signals above about 700 Hz, and U3 amplifies the signal from the audio filter to listening level. That's it!

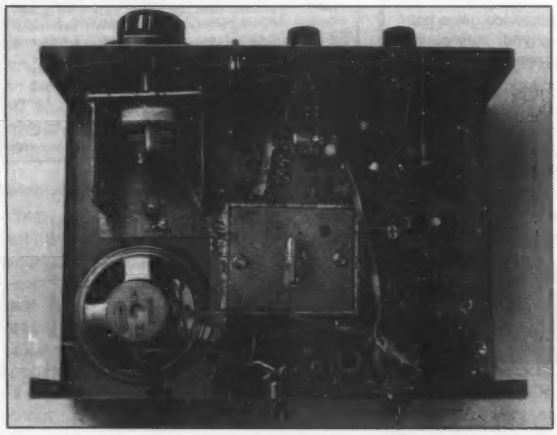


Photo B. Top view of the inside of the QRP rig. Note the double-sided PC board, for improved grounding. The VFO RF shielding (upper left) is easily tack-soldered on.

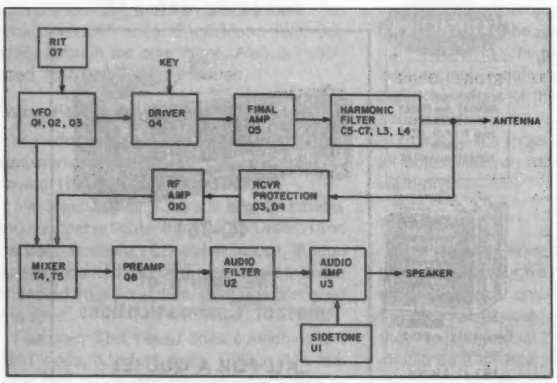


Figure 1. QRP transceiver flowchart. Note callouts (Q1, Q4, U2, etc.) which help you locate that section of the transceiver on the schematic.

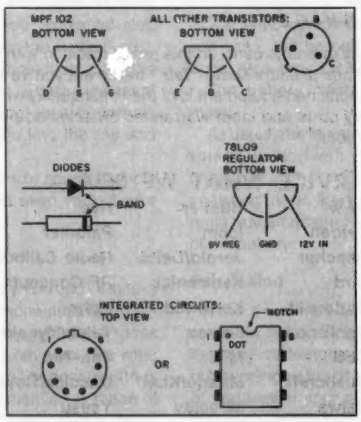


Figure 2. Base diagrams for the semiconductors used in this project.

Specific Rig Components

VFO: The VFO is a simple, well-known Hartley circuit. Drift is minimal. Frequency generation is mostly dependent upon the L1 and capacitors C1–C4. When plotted out, these components yield the VFO's operating frequency. C2 is the main tuning capacitor, and C4 is a miniature trimmer. This is important for

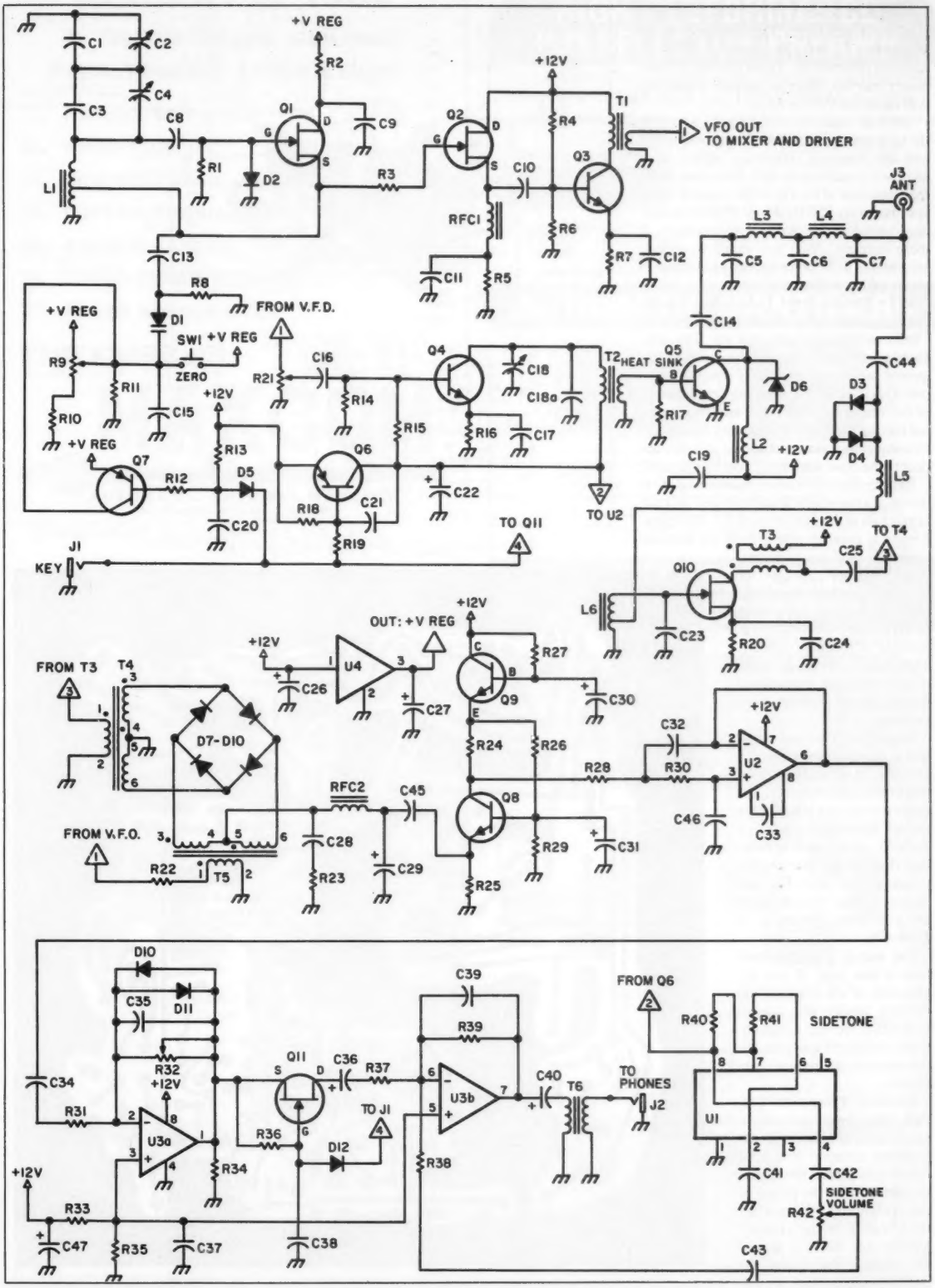


Figure 3. Schematic for the QRP transceiver.

zeroing the frequency of the VFO to calibrate it to the proper range. The remainder of the capacitors, C1 and C3, should be NPO ceramic or polystyrene. These provide the necessary stability. Regular ceramic capacitors will cause the VFO to drift.

The 5 pF capacitor off the tap of L1 couples the tank circuit to the diode that provides RIT and the transmit frequency offset. It is switched in and out by Q7. The offset shifts the frequency of the rig in the transmit mode approximately 750 Hz down. This is the standard offset in the amateur community. If there were no offset, you would be exactly zero beat with the other station, and neither of you would hear the other!

RIT: The Receiver Incremental Tuning (RIT) circuitry is probably the handiest of "bells and whistles" on this rig. This provides a method of moving the receiver frequency while the transmit frequency stays put. This is useful for adjusting the frequency of the tone of the station you are listening to, but leaving the transmit frequency stationary. Consequently, your frequency will not appear to the other station to crawl up the band.

Driver: The NPN driver transistor (Q4) is driven at a fairly high level from the VFO and is matched to the final through T2. The transformer is parallel with a 5–50 pF trimmer capacitor (and an additional 22 pF or 33 pF capacitor for 40 meter operation) which, together with the inductance of the primary winding of T2, provide a resonant circuit. This tuned circuit is more complicated than a broadband design, but allows more power output.

Amplifier: The final specified is the much written-about 2N3553. It gives plenty of output but, unfortunately, it is expensive and not always easy to find. Radio Shack carries a 2N3053 which will suffice, but this drops the output to about one and one-half Watts. Other possibilities are a 2N3866, 2SC2075, or MRF 476.

The output transistor must have a heat sink! If you neglect this, it will overheat and destroy itself! The output from Q5 is fed into a conventional double Pi low-pass filter network to reduce harmonics.

Receiver Protection Circuit: The transmitter and receiver sections connect directly to the antenna. You need circuitry to protect the receiver portion from the power of the transmitter. Otherwise, the 3 Watts from the transmitter will ruin the front end of the receiver. The diodes, D3 and D4, together with the resonant combination of C44 and

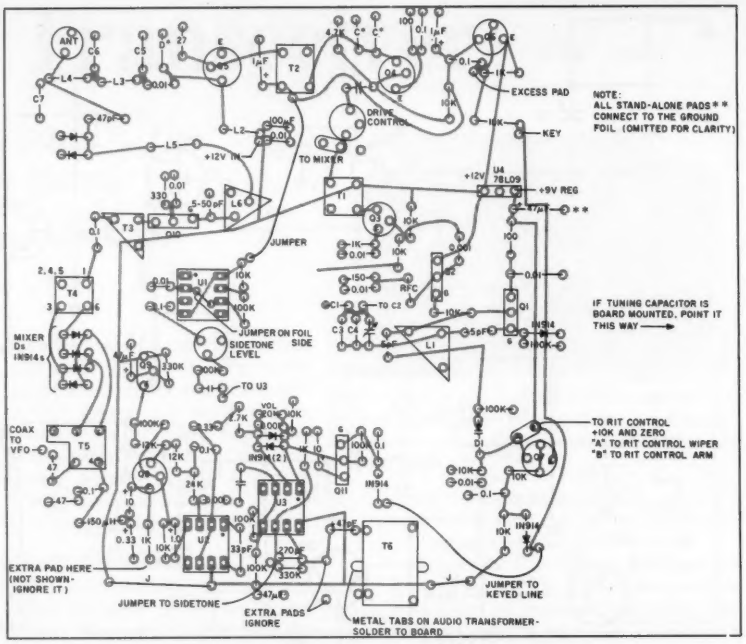


Figure 4. Parts placement guide for the QRP transceiver.

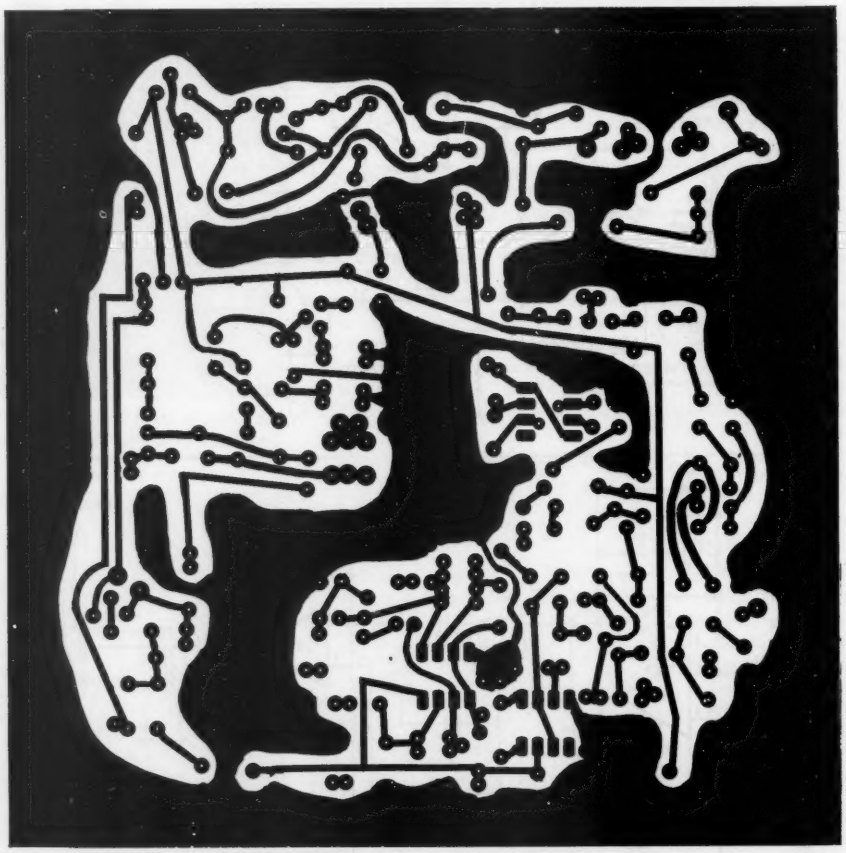
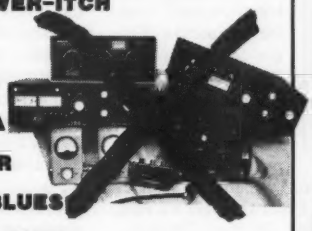


Figure 5. Printed circuit board foil diagram. Be sure to reproduce this at exactly 100%, so that components with critical lead spacings (e.g. intergrated circuits) will easily fit onto the prepared board.

JANUARY 4, 1983

A CURE WAS FOUND FOR THESE DISEASES :

1. REFLECTED POWER-ITCH
2. KNOB-ITUS
3. QRM-DEAFNESS
4. BUTTON-PHOBIA
5. SWITCH-CANKER
6. SUPER TUNER-BLUES
7. CROSS NEEDLE-EYES



THE CURE* IS:

MAXCOM

AUTOMATIC ANTENNA MATCHER ®
FOR ALL S.S.B. RADIOS

* ONE SHOT GUARANTEED TO LAST AT LEAST FIVE YEARS!

MAXCOM, INC. BOX 502, FT. LAUD., FL. 33302
305-523-6369

* MAXCOM is a registered trademark and is owned by Maxcom Electronics, Inc.

THE BOTTOM LINE: "MAXCOM WORKS"

CIRCLE 101 ON READER SERVICE CARD

HIGH PERFORMANCE PRESELECTOR-PREAMP

The solution to most interference, intermod, and desense problems in **AMATEUR** and **COMMERCIAL** systems.

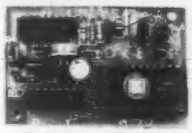
- 40 to 1000 Mhz - tuned to your frequency
- 5 large helical resonators
- Low noise - High overload resistance
- 8 dB gain - ultimate rejection› 80 dB
- 10 to 15 volts DC operation
- Size - 1.6 x 2.6 x 4.75" exc. connectors
- **FANTASTIC REJECTION!**

Typical rejection:
±600 Khz@144 Mhz: –28dB
±1.6 Mhz@220 Mhz: –40dB
±5 Mhz@450 Mhz: –50dB

Price - CALL bipolar w/RCA jacks
Connector options: BCN $5, UHF $6, N $10
SUPER HOT! GaAs Fet option $20

AUTOMATIC IDENTIFIERS

ID-1



ID-2

- For transceivers and repeaters - **AMATEUR** and **COMMERCIAL**
- Automatic operation - adjustable speed and amplitude
- Small size - easy installation - 7 to 15 volts DC
- 8 selectable, reprogrammable messages - each up to 2 min. long
- Wired, tested, and programmed with your message(s)

Model ID-1 - $54.95 Model ID-2 w/2 to 10 minute timer - $79.95

We offer a complete line of transmitter and receiver strips and synthesizers for amateur and commercial use.
Request our free catalog. *Mastercard and VISA welcome*

GLB ELECTRONICS, INC.

151 Commerce Pkwy., Buffalo, NY 14224
716-675-6740 9 to 4

CIRCLE 17 ON READER SERVICE CARD

BATTERIES "R" US...

You've bought our replacement batteries before...
NOW YOU CAN BUY DIRECT FROM US, THE MANUFACTURER!

ICOM
CM2, PB2 7.2v @ 500MAH
CM5, PB5 10.8v @ 500MAH
SUPER 7S & 8S
13.2v @ 1100MAH
9.6v @ 1200MAH
(base charge only – 1" longer)
Introductory Offer!
SUPER 7S & 8S - $64.95 each

JUNE SPECIAL!
ICOM-8(S) Complete Battery Pack
An Additional 10% OFF
Special introductory offer for all orders received in June.

SPECIAL:
CAMCORDER BATTERY
Panasonic's equivalent—
PB-80—$40.00
An additional 10% savings over normal pricing.

Look for July Special!

YAESU/MAXON
*FNB-10 7.2v @ 600MAH
FNB-12 12v @ 500MAH
*FNB-10(S) 7.2v @ 1000MAH
*same size case as FNB-12

Introductory Offer!
P4W 11v @ 500MAH - $22.63
FNB-2 11v @ 500MAH - $22.63

CUSTOM MADE BATTERY PACK & INSERTS
Made to your specifications.

KENWOOD INSERTS
PB-21—$13.75, PB-25—$20.00
PB-28—$20.00
ICOM INSERTS
BP-5—$23.00, BP-3—$18.95,
BP-7, BP-8

Prices subject to change without notice.

MasterCard and Visa cards accepted. NYS residents add 8¼% sales tax. Add $3.50 for postage and handling.

SOURCE FOR ALL YOUR COMMUNICATION BATTERY REPLACEMENT NEEDS.

W & W ASSOCIATES

29-11 Parsons Boulevard, Flushing, N.Y. 11354
WORLD WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE.

OUR PRICES CAN'T BE BEAT. SEND FOR FREE CATALOG AND PRICE LIST

In U.S. & Canada Call Toll Free (800) 221-0732 • IN NYS (718) 961-2103 • Telex: 51060 16795 • FAX. (718) 461-1979

CIRCLE 191 ON READER SERVICE CARD

Table 2: Frequency Dependent Values

Part	30 Meters	40 Meters
C1,3	150 pF	200 pF
C5,7	270 pF	470 pF
C6	560 pF	1000 pF (equals 0.001mF)
L1	27 turns, #26 wire, T-50-6 toroid	34 turns, #26 wire, T-50-6 toroid
L3,4	12 turns, #22, T-50-2	14 turns, #22, T-50-2
L5	34 turns, #28 or 30, T-50-6	50 turns, #28 or 30, T-50-6
L6	45 turns, #28 or 30, T-50-2	45 turns, #28 or 30, T-50-2
C18a		Radio Shack 272-1437 (22 pF)

These parts must be obtained from either Radiokit, Circuit Specialists, or Mouser (except C18a).

L5, prevent this problem.

RF Amp: This device amplifies the incoming received signals to give the receiver a little more punch and better signal-to-noise ratio.

Mixer: The mixer is a doubly-balanced mixer using the common 1N4148 or 1N914 diode. The difference between the antenna's signals and the VFO's frequency yields the audio frequency appearing at the speaker. This is the most fearsome looking part of the circuit. It is actually the most fun to build.

Audio Chain: The preamp, Q8, in conjunction with U3, amplifies the audio to listening level. The audio filter U2 is a low-pass filter of conventional design. It cuts off at approximately 700 Hz.

Some Simple Rules of Home-brew

You can build this project quickly and easily if you observe a few simple rules that are common to any hobby or craft. These are absolutely indispensable:

•Know the rig. Study the schematic and plans very thoroughly. Be familiar with the modules and know what they are designed to accomplish.

•Know the parts. Be familiar with what parts make up the project. Study the parts placement guide, Figure 4, and match the flow of the circuitry against the parts placement guide. Also, remember that you can destroy a part by reversing polarities, etc.

•Go slowly! This one piece of advice will save you hours of teeth-gritting tension and frustration later. There is no exception to this rule.

•Go methodically. Build this project module-by-module, where possible. This will help to prevent many possible problems and will enhance the learning potential of this project.

Order of Construction

Do not be afraid to etch a single- or double-sided circuit board yourself. Copy the foil pattern (Figure 5) directly onto Tech-200 film (Tech-200 is supplied by the Meadowlake Corp., PO Box 497, Northport NY 11768), which is etch-resistant, or purchase supplies from Radio Shack. Otherwise, get a circuit board from a supplier. (Midland Technologies, 34374 E. Frontage Road, Bozeman MT 59715, 406-586-1190. Contact is Lee Lester. Double-sided tinned PC board, price $12.50 plus shipping and handling.) There are also a limited number of complete parts kits available, including printed circuit board. (Tanner Electronics, 1301 West Beltline Road, Carrollton TX 75006, 214-242-8702. Contact Jim Tanner. Complete kit, less case, is under $73.00.)

Modular Approach

I leave this to the whim of you, the builder, but consider these suggestions, which follow the modular approach.

VFO: Assemble the VFO components through T1 first. C2 is an air variable. You can mount it on the front panel, or on one of four PC board square "walls" that can be soldered to the board to shield the VFO from the rest of the components of the rig. After you have completed the VFO, apply voltage to it. Place the board near the receiver antenna connection to find the VFO frequency in a general coverage receiver. Note how C2 and trimmer C4 change the frequency. Set the tuning capacitor to its fully-meshed position and adjust C4 for the low frequency of the segment of the board you wish to work. A vernier dial for the VFO is nice but not essential.

You may need to do some experimenting to get the frequency exactly at the right spot. Also, you may have to add or subtract a small amount of capacitance (remember: NPO or polystyrene), no more than 20 pF or so. Adding capacitance will lower the VFO frequency.

RIT: Assemble the RIT circuitry. Note that the RIT control R9, and the resistor R10 connected to it, are not board-mounted. Apply voltage to the circuitry. Notice that when you close the key the transmit frequency will be changed. Note also that when you rotate the 10k pot without the key closed the frequency changes. Setting the pot at zero resistance sets the receiver at the transmit frequency. Rotating the control gives the offset. If you experiment enough, you'll find a good offset. SW1 is a "zero" button, which allows instant reference to the transmit frequency.

Transmitter: Assemble the remainder of the transmitter slowly, paying careful attention that parts are assembled on the board neatly and correctly. Connect a dummy load and key. Ground R19 off the base of Q6, which will key the transmitter. A wattmeter will verify the output. Tweak the output with trimmer C18. Turn drive control R21 (board mounted) until the output is 3 Watts. In some cases, R21 may cause the transmitter to become unstable. If so, consider omitting it.

Receiver: Assemble the remainder of the receiver. There is no easy way to compartmentalize it in any smaller components, so you must assemble most of the receiver section at one time. However, if you wish, you can omit the RF amp for the time being, route the antenna directly to T3 of the mixer, and assemble the RF amp after you're sure that the remainder of the receiver works properly.

Sidetone: Assemble U1 and its associated components. The trimpot adjusts the volume of the sidetone into the last audio stage. The sidetone level is independent of the volume control. Don't forget the jumper to U3!

Construction Hints

There are a number of hints that might help you to assemble the rig and to avoid blowing up parts.

•Parts are generally noncritical, except in tuned circuits. I tried to stick to common values. If you need to substitute because of a shortage in your junk box, try it. Remember that connecting capacitors in parallel will increase the total capacitance by the sum of their values. This information is useful if you need an NPO cap but don't have the exact value. You might also use polystyrene caps or silver micas, but there may be some drift.

•Refer to the base diagrams of the semiconductors in this project (Figure 2). It is very common to reverse connections of transistors and polarities of diodes, electrolytic capacitors, etc. Make sure you do not switch the diode in the RIT circuit with the other 1N914 diodes.

•Toroids may seem forbidding, but are easier to get the hang of than tying your shoe. The T-50-2 is a red core, and the T-50-6 is a yellow core. The "50" refers to its size (0.50 inch), and the "6" is the core material. The FT-37-43 or FT-37-61 cores are black (use either one, whichever you find).

•The mixer transformers are "trifilar" wound. That is, 3 wires are twisted together 8 turns per inch, and then the twisted group are wound the correct number of turns around the core.

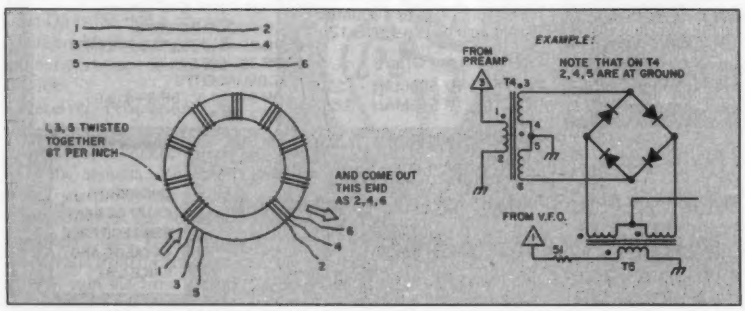


Figure 6. Details on winding toroidal coils. The doubly-balanced mixer in the main schematic (Figure 3) is reproduced here.

TABLE 1: PARTS LIST

Part Callout	Value Description	RS Part No.	Other Supplier
C9,16,20,21,28, 32,38,42,43	0.1µF	272-135	
C11,12,14,17,19,24,25,41	0.01µF	272-131	
C10,35,46	0.001µF	272-126	
C1,3,5,6,7	SEE TABLE 2, FREQUENCY DEPENDENT VALUES		
C2	35µF air variable, panel-mounted		Radiokit, Jackson, 4667-50
C4	15 pF trimmer, NPO or air variable, board-mounted		Radiokit, EF Johnson, 193-0004-001
C8,13	5 pF NPO ceramic		Radiokit
C15,44,47	47 pF	272-121	
C18	5–50 pF trimmer, PC-mount	272-1340	
C18a (40m operation)	33 pF	272-1437 (22 pF)	
C22	1µF	272-1434	
C26	100µF electrolytic	272-1016	
C27,30,37,40	47µF electrolytic	272-1015	
C29,34	0.33µF	272-1433 (0.47µF)	
C31,36,45	10µF electrolytic	272-1013	
C33	33 pF	272-121 (47 pF)	
C39	270 pF	272-124 (220 pF), plus 272-121 (47 pF)	
R1,8,13,26,33,35,36,38,41	100k	271-1347	
R2,16	100Ω	271-1311	
R3,4,6,10,11,12,15,19,29,34,40	10k	271-1335	
R5	150Ω	Use 100	
R7,18,25,37	1k	271-1321	
R9	10k panel mount	271-1721	
R14	4.7k	271-1330	
R17	27Ω	271-007 (33 ohms)	
R20	330Ω	271-1315	
R21	1k PC mount	271-333*	
R22,23	47Ω	271-009*	
R24,28	12k	use 10k	
R27,39	330k		
R30	24k	271-1339 (22k)	
R31	2.7k	271-1335 (2.2k)	
R32	Any panel mount pot, 10k-100k	271-1716 (50k)	
R42	10k PC mounted trimpot	271-335*	
D1	varactor, zener or rectifier diode	276-564 (15v zener)	
D2-D12 (except D6)	1N914 or 1N4148	276-1122	
D6	33v zener (optional)		Radiokit
L1	See TABLE 2: FREQUENCY DEPENDENT VALUES		
L2	10 turns, #26 wire on FT-37-43 toroid		Radiokit
L3-6	See TABLE 2: FREQUENCY DEPENDENT VALUES		
Q1,2,10,11	MPF-102	276-2062	
Q3,8,9	2N2222	276-2009	
Q4	2N2222A	276-2009	
Q5	2N3553		Circuit Specialists
Q5 (optional)	2N3053	276-2030	
Q6,7	2N3906	276-1604	
U1	NE555	276-1723	
U2	LM301 single op amp	276-007 (741 op amp)	
U3	LM358	276-038 or 276-1715 (1458 or TL081)	
U4	78L09 regulator		Radiokit
RFC1,2	100µH molded choke		Radiokit
T1	Primary 15 turns,#26 wire; Secondary 3 turns over collector end of primary, on FT-37-43 toroid		Radiokit
T2	45 turns, #30 wire, T-50-6 toroid		Radiokit
T3	7 bifilar turns, #26 wire, FT-37-43 toroid		Radiokit
T4,T5	7 trifilar turns, FT-37-43		Radiokit
T6	1k to 8Ω audio transformer, clip off center tap	273-1380	
J1,2	Phone jack	274-252	
J3	S0-239 coax receptacle	278-201	
SW1	Pushbutton, normally open	275-1571	
	Printed Circuit Board Etching Kit	276-1576	
	Cabinet	270-253 (Other cabinets available)	
	Enameled wire for toroids	All sizes available	
	Heat Sinks		Circuit Specialists, Mouser Electronics
	Stand-off insulators	276-195	

* These parts are correct values, but are larger than are designed to be placed on the board. Smaller sizes available at other suppliers:

Radiokit
P. O. Box 973
Pelham NH 03076
(605) 635–2235

Circuit Specialists
P.P. Box 3047
Scottsdale AZ 85271-3047
(800) 528–1417

Mouser Electronics
2401 Hwy. 287 North
Mansfield TX 76063
(800) 346–6873

If bought new or unused, cost will be under $73.00!

continued on p. 49

The G3IGU Transceiver

QRP on 80 meters.

by Keith Coates G3IGU

The circuit for the G3IGU direct conversion receiver, based upon the circuit by J. Young in the February 1975 issue of *Radio Communication*, is straightforward. The RF amplifier is tuned, though, and I found that an RF gain control is essential for evening use. The AF amplifier is a simple circuit.

Construction

The layout is not critical. The VFO, AF, and PA are very well screened, with the components mounted on a length of tag strip. The receiver and sidetone generator are built onto paxolin panels (see Figures 1 and 3), and wired up at the rear. The whole transceiver, including the ATU, is built into one box so only aerial and earth connections are required. You may also place batteries inside the case.

You may consider the PA stage odd, with the 680Ω and 10Ω resistors, but I tried several other types of coupling which resulted in accidents to the BFY51. This circuit has never damaged a PA transistor. The actual RF power output will depend upon the transistor you use. Some BFY51s have given DC power inputs of from 850 mW to 1.3 Watts.

The AF filter (L5, L6, and L7) is based on the circuit of J. Young (*Rad Com*, October 1973) using 38 SWG on Mullard ferrite rings, type FX1593. In the prototype, I used scrap ferrite rings, and I could wind only about 200 turns onto them, but they worked all right.

Wind the PA and ATU coils on ferrite rod ⅜" in diameter and 2½" long. Wind 15 turns of 20 SWG, tapping the ATU coil every two turns for aerial impedance matching.

Different values of R20 will alter the drive

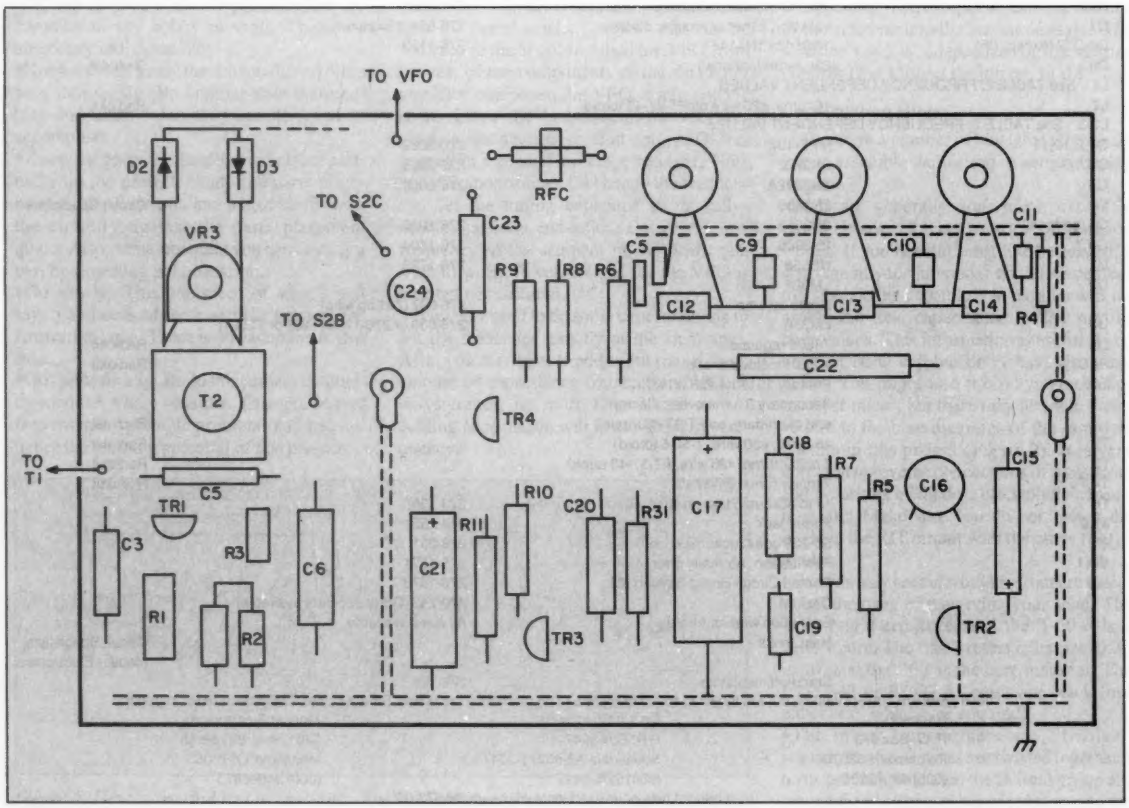
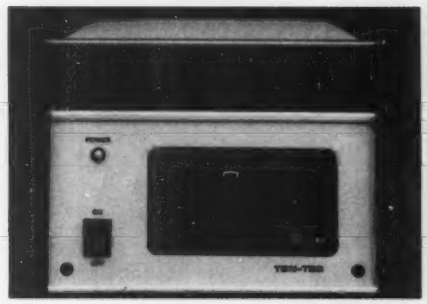


Figure 1. Parts placement for the receiver board.

...America's Best!

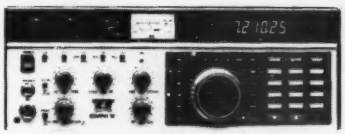
TEN-TEC

WHEN YOU ARE READY TO TRADE, CALL MEMPHIS AMATEUR AND TRADE UP TO TEN-TEC!!



The PARAGON...Performance Plus! NEW!... 961 Power Supply

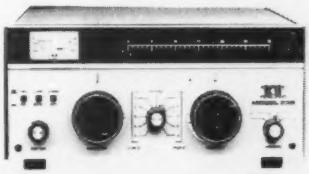
The Paragon is the result of a three year engineering effort. We are proud of the Paragon and we think it has set new standards of excellence in synthesized rigs. Check it out yourself. We think that you will share our pride in the Paragon.

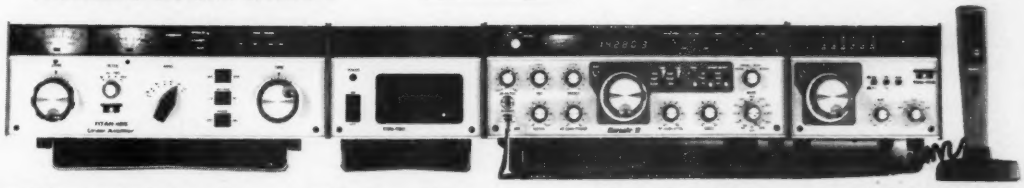


COMING SOON: OMNI V

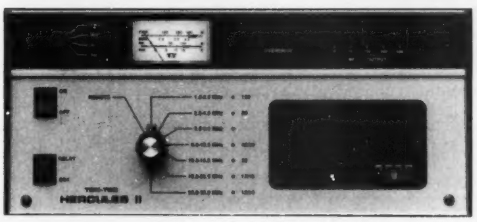
CALL FOR TRADE APPRAISAL!

TEN-TEC 238 2-KW Antenna Tuner

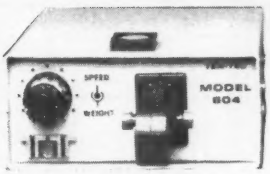




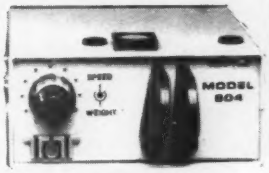
MODEL 425 TITAN | 961 Power Suply | 561 CORSAIR II | 238-G VFO MIC



COMING SOON—HERCULES II AMP
Solid State, No-Tune, 550 Watts HF



MODEL 605
SINGLE PADDLE KEYER



MODEL 604
DUAL PADDLE KEYER

CALL US TOLL FREE! 800-238-6168

MEMPHIS AMATEUR ELECTRONICS, INC.

1465 WELLS STATION ROAD, MEMPHIS TN 38108 OPEN 9 TO 5, SAT. 9 TO 12 (CENTRAL TIME) PHONE 901-683-9125

CIRCLE 331 ON READER SERVICE CARD

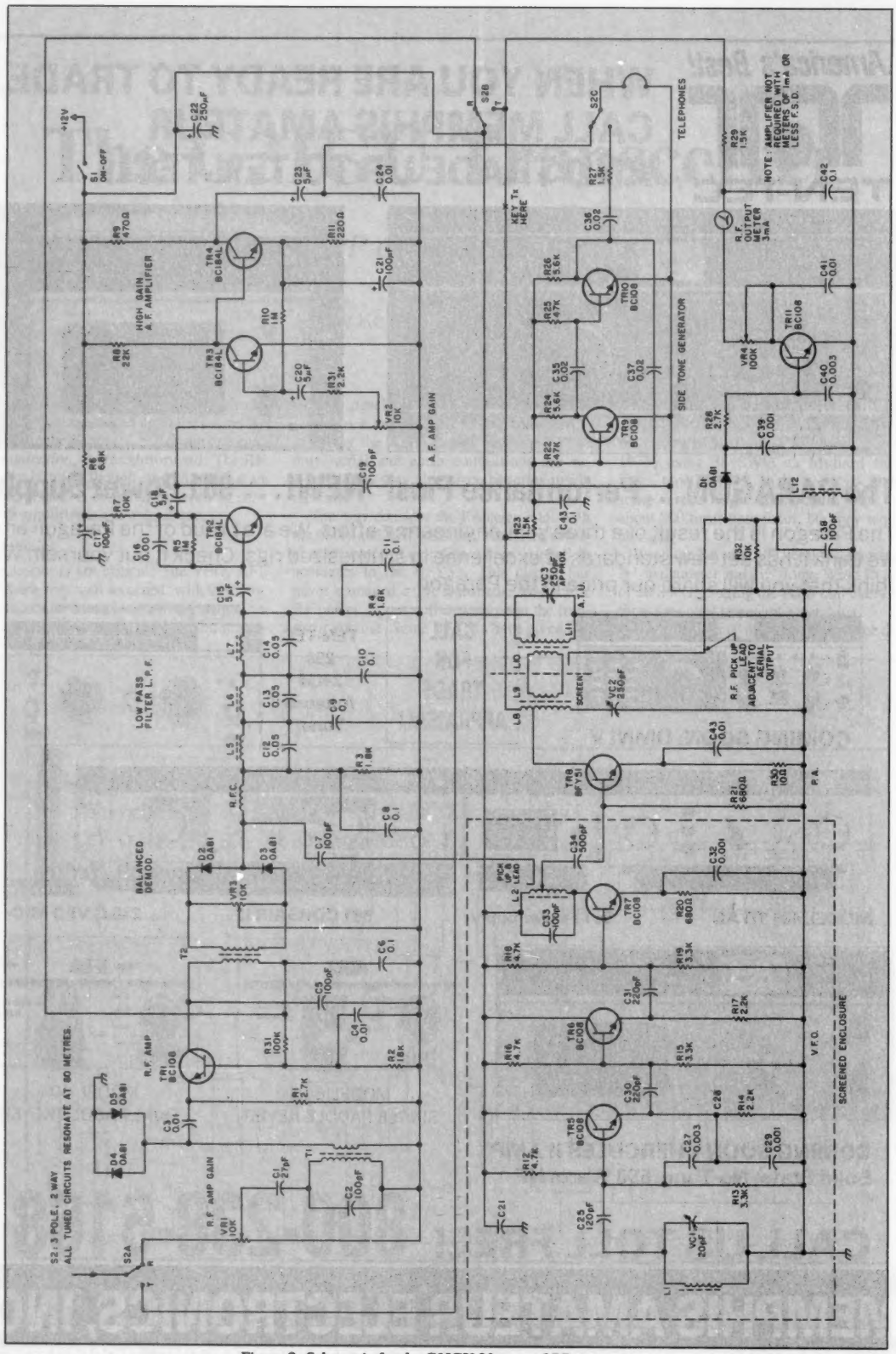


Figure 2. Schematic for the G3IGU 80 meter QRP transceiver.

to the PA, giving different power outputs. A 1kΩ preset in series with a 470Ω fixed resistor will give a variable output from about 200 mW to about 1.5 Watts. This is useful for points in contest operating.

Fit a 500 mA fuse in the 12 volt supply lead, especially if you want to use a car battery—and a diode to prevent reverse polarity accidents.

Suggested Coil Windings

These notes are based on another 80 meter rig I have built, using some of the information in the J. Young article. A grid dip oscillator (GDO) is useful for tuning the coils to resonance.

T1 Primary: 40 turns 30 SWG close-wound on ⅜" former with slug. *Secondary:* 5 turns on earthy end.

T2 Primary: as T1. *Secondary:* 12 turns 34 SWG close-wound in the center of the primary.

L1: 30 turns 30 SWG on ⅜" former with the core, with 100 pF fixed and 50 pF trimmer in parallel to tune onto the CW end of 80 meters.

L2: As primary of T1, tapped about two-thirds up from the earthy end.

L8: 15 turns 20 SWG on ⅜" ferrite rod (2½" long).

L9: About 4.5 turn link on L8.

L10: As L9.

L11: As L8, with tappings about every two turns.

L12: As L2 (or perhaps a 1.5 mH RFC).

L5, L6, and L7: For each inductor, wind 200 turns of #38 wire, closely spaced on the Mullard ferrite rings. Each ring is just under ½" length and ¼" diameter. Mount the rings on the same axis spaced ¼" apart.

So, there you have it. This rig should prove to be a lot of fun to use, especially in the fall months when low-band DX picks up. Enjoy!

Adapted from "G-QRP Club Circuit Handbook."

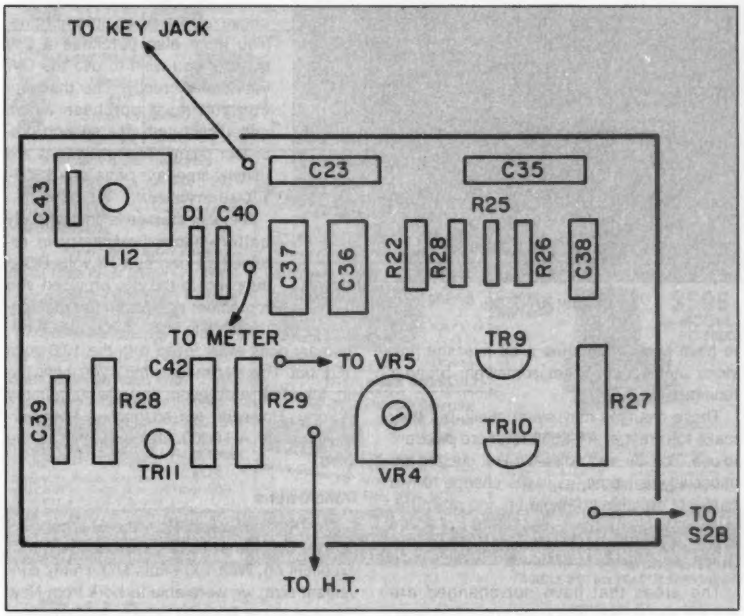


Figure 3. Parts placement for the side-tone generator and RF meter amp.

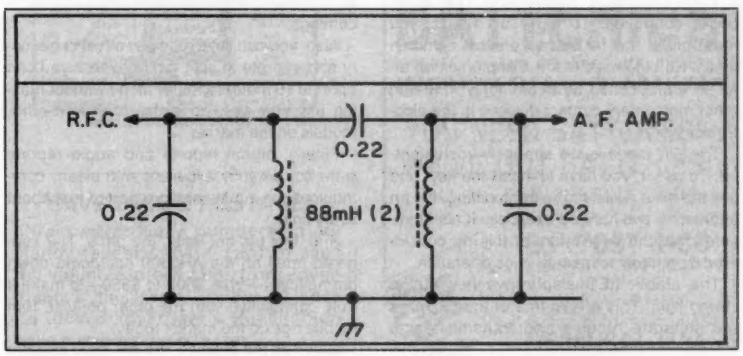
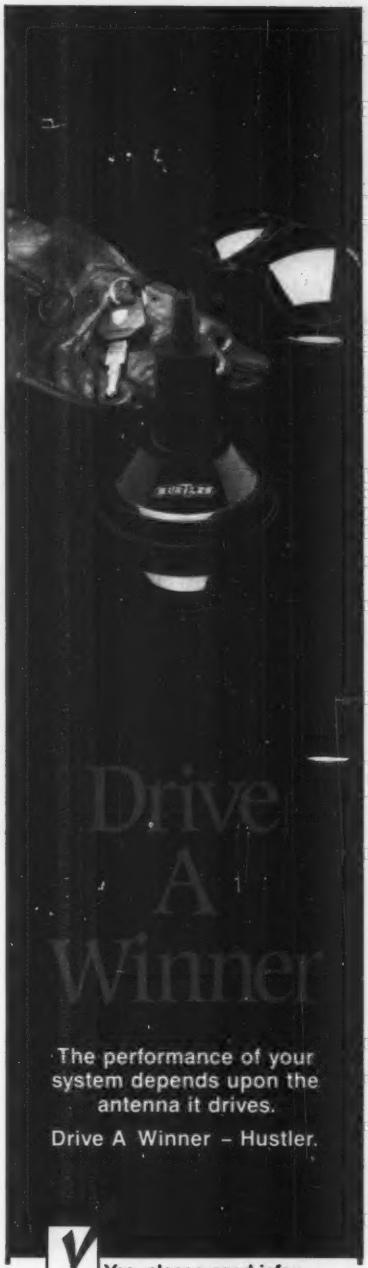


Figure 4. An alternate AF filter.



The performance of your system depends upon the antenna it drives.

Drive A Winner – Hustler.

Yes, please send information on your line of amateur antennas to:

NAME _____

ADDRESS _____

CITY STATE ZIP

HUSTLER®

One Newtronics Place
Mineral Wells, Texas 76067
(817) 325-1386

CIRCLE 269 ON READER SERVICE CARD

73 Review *by Marc Stern N1BLH*

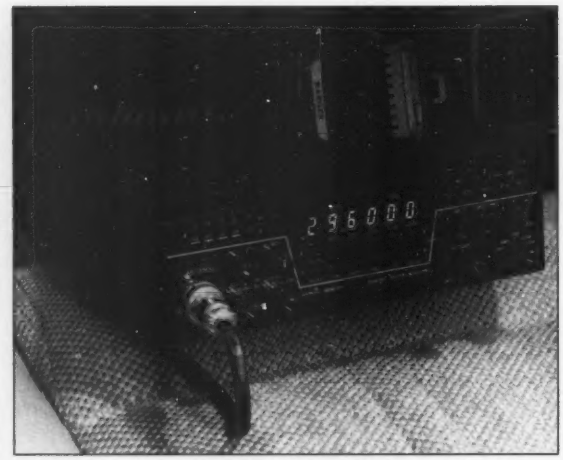
The Ranger AR-3500

Competitively-priced QRO 10m rig.

Clear Channel Corp.
Box 445
Issaquah, WA 98027
Phone: (206) 392-0419
Price Class: $350

When I last reviewed a Clear Channel Ranger 10 meter rig, I came to a couple of conclusions. The first was that the rig was a reasonable, all-mode 10 meter transceiver. The second was that it wasn't the most operator-friendly in the world.

After evaluating the AR-3500, a higher-power, updated version of the original, I have found some improvements, and some areas where things are pretty much the same.



The Ranger AR-3500.

In a Nutshell

The Ranger AR-3500 is a microprocessor-controlled 10 meter transceiver with 100 Watts of output. An all-mode rig (AM, FM, SSB, and CW), it features true noise blanking and noise limiting. It has outputs for CW and an external speaker. An amber LED display gives resolution to the nearest 10 Hz. It covers 28.000 to 29.995 MHz and offers splits for repeater use. Specifications put the dynamic range at roughly 105 dBm, and spurious emission suppression meets FCC specifications at about 60 dB down. The Ranger AR-3500 also offers five memories, memory scan, and programmable band scan. It weighs roughly 5 pounds and is about as big as an older 2 meter rig.

Improvements Over the AR-3300

The Ranger AR-3500 is an improvement over the AR-3300, which I reviewed last year, in the following ways:

Instead of using one set of momentary-contact switches for increasing or decreasing frequency, there are now two banks of switches under the display. The top bank is for increasing frequency and the bottom is for decreasing frequency.

There is now a real, highly effective, noise-blanker circuit. You activate it by pushing in the RF gain knob. It pretty much cancels just about all mobile noise.

By pushing in the mike gain knob, you can now activate a true automatic noise limiting circuit. This feature complements the noise blanker and helps limit noise peaks.

The RIT control, called the clarifier, seems to have been opened up a bit over the previous model and offers somewhat broader tuning.

These changes may seem small, but they make the Ranger AR-3500 far more pleasant to use. The ANL and noise-blanker circuits are especially welcome, as is the change to two banks of switches to move up and down frequency.

Still the Same

The areas that have not changed are still the same ones which we noted last year. They are:

There's no knob for the VFO. QSYing is button-controlled. To move up 10 Hz, you must press the far button on the right ten times. No automatic mode is implemented after several seconds, as is commonly done with other momentary-contact devices in the electronics world.

The CW mode is still strangely implemented. To use it, you have to insert the key, and key the mike while you're transmitting. It's an interesting two-handed exercise. It also indicates that the developers of this rig considered it primarily for mobile voice operation.

The amber LED display washes out in strong light. This is also true of the LEDs for the separate receive and transmit signal strength indicators.

Scan mode is only activated with the squelch in a high position. It takes a lot of signal to overcome the squelch, which works in any mode.

If you want the convenience of using the mike instead of the up-down switches, you must purchase an up-down microphone. You must also purchase a CW board if you wish to use the CW interface correctly. The third option you must purchase as an added-cost item is a speech processor board. These features are usually standard parts of a $600–$700 transceiver.

Memory storage is only partially battery-backed. Memory is retained as long as 13.8 volts DC is supplied to the rig, provided you remember not to turn the memory reset switch off. If you turn it off, memory goes away, even with the 13.8 volts DC input. This also means that if you move the rig, for whatever reason, there is no memory storage. However, we suspect in later versions of the AR-3500, the problem will be fixed.

Conclusions

So, the final verdict on the Ranger AR-3500? Despite the above shortcomings, it's an excellent rig. With 100 Watts and a fairly convenient size, we were able to work from New England to the Midwest reliably and with less than optimum band conditions. The extra 6.02 dB of power more than makes up for any shortcomings.

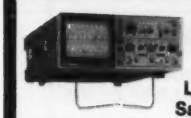
Also, you can set a repeater offset in memory and operate in split mode so that you can operate 10 meter repeater mode without making any changes, as is the case with other models on the market.

Finally, signal reports and audio reports were consistently excellent with clean, communications-quality audio reported just about every time.

And, last but not least, the price. The suggeted retail on the AR3500 has come down dramatically—from $600 to $350—to make it truly competitive with the other popular 10m mobile rigs on the market today.

Given all the plusses, the AR-3500 is worth a look by the serious 10 meter operator. 73

HITACHI SCOPES AT DISCOUNT PRICES



V-212 $419
List $560
Save $141

20MHz Dual Trace Oscilloscope
All Hitachi scopes include probes, schematics and Hitachi's 3 year guaranty on parts and labor. Many accessories available for all scopes.

V-425 $835
List $995
- DC to 40MHz
- Dual Channel
- CRT Readout
- Cursor Meas
- DC Offset
- Alt Magnifier
- Compact Size

V-1060 $1,325
List $1595
- DC to 100MHz
- Dual Channel
- Delayed Sweep
- CRT Readout
- Sweep Time
- Autoranging
- Trigger Lock
- 2mV Sensitivity

			LIST	PRICE	SAVE
V-223	20MHz	D.T., 1mV sens, Delayed Sweep, DC Offset, Vert Mode Trigger	$770	9695	$75
V-422	40MHz	D.T., 1mV sens, DC Offset Vert Mode Trigger, Alt Mag	$875	$725	$150
V-423	40MHz	D.T., 1mV sens, Delayed Sweep, DC Offset, Alt Mag	$955	$825	$130
V-660	60MHz	D.T., 2mV sens, Delayed Sweep, CRT Readout	$1,195	$1,025	$170
V-1065	100MHz	D.T., 2mV sens, Delayed Sweep, CRT Readout, Cursor Meas	$1,895	$1,670	$225
V-1100A	100MHz	D.T., 1mV sens, Delayed Sweep, CRT Readout, DVM, Counter	$2,295	$2,045	$250
V-1150	150MHz	D.T., 1mV sens, Delayed Sweep, Cursor Meas, DVM, Counter	$3,100	$2,565	$535

ELENCO PRODUCTS AT DISCOUNT PRICES

20MHz Dual Trace Oscilloscope

$359
MO-1251
- 6" CRT
- Built in component tester
- TV Sync
- X-Y Operation

See Us At Dayton!

SCOPE PROBES
P-1 65MHz, 1x, 10x $19.95
P-2 100MHz, 1x, 10x $23.95
Fits all scopes with BNC connector

35MHz Dual Trace Good to 50MHz

$495
MO-1252
- High luminance 6" CRT
- 1mV Sensitivity
- 6KV Acceleration Voltage
- 10ns Rise Time
- X-Y Operation • Z Axis
- Delayed Triggering Sweep

Top quality scopes at a very reasonable price. Contains all desired features. Two 1x, 10x probes, diagrams and manual. Two year guarantee.

Autoranging DMM M-5000 $45
9 Functions Memory and Data hold ½% basic acc 3½ digit LCD

True RMS 4½ Digit Multimeter M-7000 $135
.05% DC Accuracy .1% Resistance with Freq. Counter and deluxe case

Multimeter with Capacitance and Transistor Tester $55 CM-1500
Reads Volts, Ohms, Current, Capacitors, Transistors and Diodes with case

Digital Capacitance Meter CM-1550 $58.95
9 Ranges 1pf-20,000ufd .5% basic accy Zero control with case

Digital LCR Meter LC-1801 $125
Measures Coils 1uH-200H Caps .1pf-200uf Res .01-20M

AC Clamp-On Current Adapter ST-265 $22
0-1000A AC Works with most DMM

Bench DMMS
M-3500 3½ digit .1% accy $125
M-4500 4½ digit .05% accy $175

SOLDERING STATION TEMPERATURE CONTROLLED SL-30 $135
Digital display Temp range: 300F-900F Grounded tip Overheat prot

Solderless Breadboards
9436 SHOWN
9430 1,100 pins $15
9434 2,170 pins $25
9438 2,860 pins $35
All have color coded posts

Low Cost Multimeter M-1600 $25
3½ digit LCD 1% DC Accy 10A Scale Auto zero /polarity

Wide Band Signal Generators
SG-9000 $129
RF Freq 100K-450MHz AM Modulation of 1KHz Variable RF output
SG-9500 with Digital Display and 150MHz built-in Freq Ctr $249

3½ Digit Probe Type DMM M-1900 $39
Convenient one hand operation Measures DCV, ACV, Ohms Audible continuity check, Data hold with batteries and case

Function Generator Blox #9600 $28.95
Provides sine,tri,squ wave From 1Hz to 1MHz AM or FM capability

Decade Blox 9610 or 9620 $18.95
#9610 Resistor Blox 47 ohm to 1M & 100K pot
#9620 Capacitor Blox 47pf to 10MFD

Digital Triple Power Supply XP-765 $249

0-20V at 1A
0-20V at 1A
5V at 5A
Fully Regulated, Short circuit protected with 2 Limit Cont., 3 Separate supplies
XP-660 with Analog Meters $175

Quad Power Supply XP-580 $59.95

2-20V at 2A
12V at 1A
5V at 3A
-5V at 5A
Fully regulated and short circuit protected
XP-575 without meters $39.95

10MHz XT 100% IBM® Compatible
5 Year Warranty
$595
MODEL PC-1000

- 5/10MHz Motherboard
- 8 Expansion Slots
- Math Compressor Slots
- 360K Floppy Drive
- AT Style Keyboard
- 150W Power Supply
- 256K RAM Expandable to 640K
- Monochrome Monitor
- Monographic Video Card
- Parallel Printer Port

FREE spreadsheet and word processor
3.3MS DOS and GW Basic add $75

Four-Function Frequency Counters
F-1000 1.2GH $259
F-100 120MH $179

Frequency, Period, Totalize, Self Check with High Stabilized Crystal Oven Oscillator, 8 digit LED display

GF-8016 Function Generator with Freq. Counter $239

Sine, Square, Triangle Pulse, Ramp, .2 to 2MHz Freq Counter .1 - 10MHz
GF-8015 without Freq. Meter $179

WE WILL NOT BE UNDERSOLD!
UPS Shipping: US 5% ($10 Max) IL Res., 7% Tax

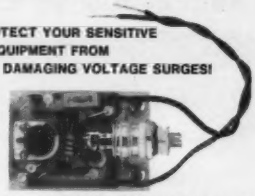
C & S SALES INC.
1245 Rosewood, Deerfield, IL 60015
(800) 292-7711 (312) 541-0710

15 Day Money Back Guarantee
2 Year Warranty
WRITE FOR FREE CATALOG

CIRCLE 356 ON READER SERVICE CARD

THE SYSPEC CROWBAR (OVP) PCB

PROTECT YOUR SENSITIVE EQUIPMENT FROM DAMAGING VOLTAGE SURGES!



FULLY ADJUSTABLE TRIP POINT

INSTALLS EASILY IN YOUR DC POWER SOURCE TO PROVIDE MAXIMUM PROTECTION TO ALL EQUIPMENT OPERATING BELOW 30 VDC

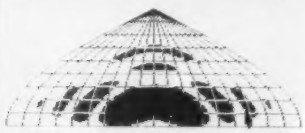
ONLY $25.00 EACH

S4SPEC INC
PO BOX 2546
SYRACUSE, NEW YORK 13220
(315) 699-7513

ORDER FACTORY DIRECT -COD'S WELCOME
$25.00 FREE SHIPPING
(NEW YORK RESIDENTS ADD 7% TAX)

CIRCLE 377 ON READER SERVICE CARD

ANTENNA MODELING



Easy to use, with menus, and optional mouse. Enter parameters, and get a color coded sinusoidal projection of a MW or SW antenna. Move over the projection with a mouse or cursor and read the gain at that point.

LONG WIRE PRO models long wires, vees, dipoles, and rhombics displaying a sinusoidal projection. $40

VERTICAL PRO models single verticals or arrays displaying a sinusoidal projection, a ground wave plot, and the impedance of each element. $80

IBM PC compatible, DOS 2.0 or higher, 256K, CGA or EGA color required. International orders add $5 shipping.

EPSILON CO
Box 715, Trumbull CT, 06611, (203) 261-7694

CIRCLE 324 ON READER SERVICE CARD

Field Day Antenna Installation System

Operation installs in minutes
ANTENNA LAUNCHING MADE EASY
Info $1.00
Re-usable Ready for Action Fast & Easy to Use Eliminates Climbing

$29.95 add $5 Air Ship
1-801-373-8425
AntennasWest
Box 50082-S, Provo, UT 84605

CIRCLE 304 ON READER SERVICE CARD

BATTERIES
Nickel-Cadmium, Alkaline, Lithium, Etc.
INDUSTRIAL QUALITY

YOU NEED BATTERIES?
WE'VE GOT BATTERIES!
CALL US FOR FREE CATALOG

E.H. YOST & CO.
EVERETT H. YOST KB9X1
7344 TETIVA RD.
SAUK CITY, WI 53583
ASK FOR FREE CATALOG
(608) 643-3194

CIRCLE 112 ON READER SERVICE CARD

NEW!
MORSE TUTOR
Made Easy & Fun

Introducing the most Comprehensive and Easy-to-Use code course available today!
—MORSE TUTOR is available for IBM PC, XT, AT, PS/2 and compatibles.

FEATURING!
- ★ 1–100 word/minute code speeds
- ★ Standard or Farnsworth modes
- ★ Adjustable code frequency
- ★ Over 1 Billion possible random QSOs
- ★ Letter, number, and punct. mark coverage
- ★ Self calibrating/menu driven design
- ★ Display text—while listening or after copying

To Upgrade or learn CW, Send check or M.O. for $19.95 + $2 S&H to:

"Morse Tutor is, quite simply, a superb value" Bryan Hastings, KA1HY July, 1988, 73 Magazine

GGJE

REFER TO QST JULY '88 P. 49

21881 Summer Circle, Dept. MTS
Huntington Beach, CA. 92646
CA. Residents add $1.20 sales tax

NOW AVAILABLE THRU UNCLE WAYNE'S BOOKSHELF, THE ARRL & FINE DEALERS EVERYWHERE

CIRCLE 339 ON READER SERVICE CARD

SAVE TIME & POSTAGE!

Circle advertiser's numbers on our handy reader service card to send for valuable information from advertisers in this issue. Use our Ad Index to locate advertiser's Reader Service numbers even faster!

AMERITRON®

SYMBOL OF ENGINEERING INTEGRITY. . .QUALITY WORKMANSHIP. . .RELIABLE LONG-LIFE PERFORMANCE

AL-80A LINEAR AMPLIFIER

The AL-80A will provide a signal output that is within 1/2 "S" unit of the signal output of the most expensive amplifier on the market—and at much lower cost.

The Ameritron AL-80A combines the economical 3-500Z with a heavy duty tank circuit to achieve nearly 70% efficiency from 160 to 15 meters. It has wide frequency coverage for MARS and other authorized services. Typical drive is 85 watts to give over 1000 watts PEP SSB and 850 watts CW RF output. A new Pi-L output circuit for 80 and 160 gives full band coverage and exceptionally smooth tuning.

Size: 15½"D. x 14"W. x 8"H. Wgt. 52 lbs.

AL-1200 LINEAR AMPLIFIER

3CX1200 TUBE

Full legal output with 100 watts drive.

AL-1500 LINEAR AMPLIFIER

8877 TUBE

Full legal output with 65 watts drive.

The cooling system in both amplifiers keeps the tube safely below the manufacturers ratings even when operating at 1500 watts output with a steady carrier. The filament supply has inrush current limiting to insure maximum tube life.

Size: 18½"D. x 17"W. x 10"H. Wgt. 77 lbs.

AL-84 LINEAR AMPLIFIER

The **Ameritron AL-84** is an economical amplifier using four 6MJ6 tubes to develop 400 watts output on CW and 600 watts PEP on SSB from 160 through 15 meters. Drive required is 70 w typical, 100 w max. The passive input network presents a low SWR input to the exciter. Power input is 900 watts. The AL-84 is an excellent back-up, portable or beginner's amplifier.

Size: 11½"W. x 6"H. x 12½"D. Wgt. 24 lbs.

ATR-15 TUNER

The **Ameritron ATR-15** is a 1500 watt "T" network tuner that covers 1.8 through 30 MHz in 10 dedicated bands. Handles full legal power on all amateur bands above 1.8 MHz.

Five outputs are selected from a heavy duty antenna switch allowing the rapid choice of three coaxial lines, one single terminal feed or a balanced output. An internal balun provides 1:1 or 4:1 ratios (user selectable) on the balanced output terminals.

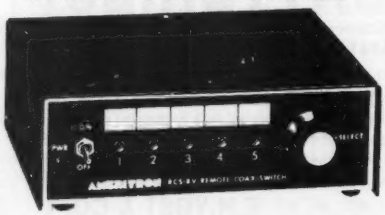
A peak reading wattmeter and SWR bridge is standard in the ATR-15. It accurately reads envelope powers up to 2KW.

Size: 6"H. x 13¼"W. x 16"D. Wgt. 14 lbs.

Remote COAX Switches

RCS-4 FOR CONVENIENT INSTALLATION

No control cable required.
Selects one of four antennas.
VSWR: under 1.1 to 1 from 1.8 to 30 MHz.
Impedance: 50 ohms.
Power capability: 1500 watts average, 2500 watts PEP maximum.



RCS-8V FOR SPECIAL APPLICATIONS

Selects up to five antennas.
Loss at 150 MHz: less than .1 dB.
VSWR: under 1.2 to 1 DC to 250 MHz.
Impedance: 50 ohms.
Power capability: 5 kW below 30 MHz, 1 kW at 150 MHz.

Available at your dealer. Send for a catalog of the complete AMERITRON line.

AMERITRON®

2375 Dorr Street • Toledo, OH 43607
For more information: (601) 323-9715 • **Technical inquiries:** (419) 531-3024

CIRCLE 314 ON READER SERVICE CARD

AMATEUR SOFTWARE FOR YOUR IBM PC/XT/AT/PS2 AND COMPATIBLES.

Bill Kantz WD2AEV
B & K Computer
1863 Cambridge Dr.
Wall, NJ 07719

SATRACK—A very simple to use satellite tracker. Will display AZ-EL for up to 10 satellites in tabular format. Also includes variable time window & time step.

COMPULOG—Sophisticated computer logging for the DX'er or contester. Search QSO's by call, prefix, name, time & date. Produces QSL report for cards to be sent and QSL's to be received.

System Requirements: 256K Memory; 1 Disk Drive; Color or Monochrome System. Programs are **$19.95** each or **$34.95** for both, plus $2.00 S/H.

VISA **TO ORDER CALL 1-800-842-9127** MC

CIRCLE 89 ON READER SERVICE CARD

NextDay QSLs
Two-Color Rainbow Assortment

Call Today &

	We Ship	NextDay	2nd Day	ASAP
100		$29.95	$24.95	$19.95
200		$39.95	$34.95	$29.95
400		$49.95	$44.95	$39.95
500		$54.95	$49.95	$44.95
1000		$99.95	$89.95	$79.95

Baraboo, Wisconsin Sauk County
K9ZZ
Info $1

AntennasWest (801) 373-8425
All orders ppd 2nd day air / priority mail. For overnight air delivery add $10.
Box 50062-S, Provo UT 84605

CIRCLE 178 ON READER SERVICE CARD

★★★★★ PRESENTING ★★★★★
CABLE TV DESCRAMBLERS
★★★★★ STARRING ★★★★★
JERROLD, HAMLIN, OAK
AND OTHER FAMOUS MANUFACTURERS

- FINEST WARRANTY PROGRAM AVAILABLE
- LOWEST RETAIL/WHOLESALE PRICES IN U.S.
- ORDERS SHIPPED FROM STOCK WITHIN 24 HOURS

FOR FREE CATALOG ONLY **1-800-345-8927**
FOR ALL INFORMATION **1-818-716-5914**

PACIFIC CABLE CO. INC.
7325 RESEDA BLVD. DEPT. 1828
RESEDA, CA 91335

CIRCLE 79 ON READER SERVICE CARD

SYNTHESIZED
SIGNAL GENERATOR

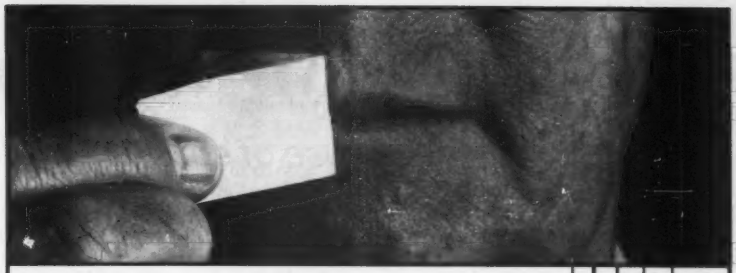
MADE IN USA

MODEL SG-100F
$429.95 delivered

- Covers 100 MHz to 199.999 MHz in 1 kHz steps with thumbwheel dial • Accuracy +/– 1 part per 10 million at all frequencies • Internal FM adjustable from 0 to 100 kHz at a 1 kHz rate • External FM input accepts tones or voice • Spurs and noise at least 60 dB below carrier • Output adjustable from 5-500 mV at 50 Ohms • Operates on 12 Vdc @ ½ Amp • Available for immediate delivery • $429.95 delivered • Add-on accessories available to extend freq range, add infinite resolution, AM, and a precision 120 dB attenuator • Call or write for details • Phone in your order as fast COD shipment.

VANGUARD LABS
196-23 Jamaica Ave., Hollis, NY 11423
Phone: (718) 468-2720 Mon.–Thurs.

CIRCLE 23 ON READER SERVICE CARD

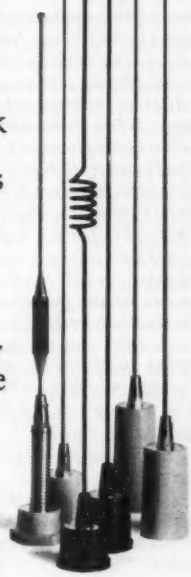


Now that you can speak, talk to Larsen.

Novice Enhancement opens up a whole new way for novices to communicate. To make the most of it, talk to Larsen Electronics.

We'll tell you how Larsen antennas can greatly improve your powers of communication. We'll also explain how Larsen 220 and 1296 MHz antennas are designed to give you the best performance.

Talk to your Larsen amateur dealer today, and see if Larsen performance doesn't speak for itself.



Larsen Antennas
The Amateur's Professional™

See your favorite amateur dealer or write for a free amateur catalog.

IN USA: Larsen Electronics, Inc., 11611 N.E. 50th Ave., P.O. Box 1799, Vancouver, WA 98668. 206-573-2722.
IN CANADA: Canadian Larsen Electronics, Ltd., 149 West 6th Avenue, Vancouver, B.C. V5Y 1K3. 604-872-8517.

CIRCLE 371 ON READER SERVICE CARD

KD8MP **IBM and APPLE DXCC** KC8AU

If you have an IBM or compatible or a 128K Apple IIe, IIc, or IIgs (with AppleWorks) you can keep track of your DXCC, WAS, or just your everyday logging with our help. With your computer you can search, order, update, or print any one of the many data fields included or you may add some of your own. This makes it easy to keep track of all the awards and QSLs in your shack. For IBM we include both the program and the data. For the Apple II series just the data is included for use with AppleWorks. Included in our data are all the I.T.U. & CQ zones plus the latitudes and longitudes of all the current DXCC countries. Also all states and counties are included!

Just **$19.95** + $2.00 s&h (Ohio residents add 5.75% for the governor).

Eightland Data
Rt. #3 Alexander Road
Bellville, Ohio 44813
or call **419-886-3807** or **419-529-5155**

($1.00 off for phone orders) Visa & MC accepted

Apple & AppleWorks are reg. TM of Apple Computer Inc. IBM is a reg. TM of International Business Machines.

The Net/ROM-NordLink Question

A case of software piracy?

by Neil Shapiro WB2KQI

Editor's Preface—As digital technology finas a larger place in amateur radio, the same complex legal and ethical problems in the computer industry are bound to crop up. This article focusses on one such issue—alleged software piracy—that has hit the amateur packet radio community.

The conflict started between two groups: Software 2000, a software development company in the US; and NordLink, an amateur packet radio club in Germany. Software 2000 developed a program, called Net/ROM, to enhance packet radio data transfer. Shortly thereafter, NordLink came out with a program, called TheNet, that had precisely the same specs—i.e., it performed the same range of tasks in the identical hardware configuration—as Net/ROM, Version 1.3. Software 2000 marketed their program—installed on a ROM chip—for $65. NordLink made their program available free of charge.

Ron Raikes WB8DED, president of Software 2000, soon began to claim that NordLink pirated the Net/ROM software. The author, Neil Shapiro WB2KQI, made his own investigation and presents his findings in this article.

See the sidebar for a brief overview of packet radio.

We want your input on this important issue. Send your correspondence in reference to "Net/ROM-NordLink Question."

. . . de Bryan NS1B

The packet radio community is now embroiled in a controversy that could affect the rest of amateur radio. On the high level, the problem focusses on principles of copyright and computer law; on the grass-roots level, it boils down to ethics and community action.

Net/ROM

Ron Raikes WB8DED, founder and owner of Software 2000, began marketing Net/ROM nodes in May 1987. Raikes began beta testing (i.e. field testing) the chip in 1986. The ROM chip he supplied plugs into many popular TNC-2 compatible terminal node controllers, such as AEA's PK-80, and MFJ's 1270/74s. The chip's instructions turn a Net/ROM-equipped TNC into in a Net/ROM node station. Other hams using factory-delivered TNCs can call into a Net/ROM node near them, often with just a 2 meter handheld or other low power transceiver.

Net/ROM is a form of extra intelligence that automates packet data routing. A station so equipped transmits a beacon with its call and a library of other Net/ROM-equipped stations it can link to. A Net/ROM station also listens to the call for the beacons of other Net/ROM stations and automatically records the information in these beacons. From this initial information, Net/ROM nodes automatically configure possible routes of linked Net/ROM nodes for packets to travel. The end result is that users transmitting a packet need only specify the destination—Net/ROM nodes take care of all the routing! With this system, convenient and low-power long-distance communications are possible, and are becoming more routine.

Raikes' product is stored on a ROM chip. Just as a computer program exists on a floppy disk or a cassette tape, it exists within a ROM chip. It helps to think of a ROM program as existing in a protective hard shell.

Too Big a Byte?

In computers, it's pretty much a given that any breakthrough product will be quickly followed by similar products, as programmers see what is possible and begin to develop their own ideas. At first, it seemed just a happy demonstration of such a development when German ham Hans George Giese DF2AU released his TheNet ROMs. His program did exactly the same thing as Ron's Net/ROM program, with the addition of two commands. All other commands and operations appeared identical. Hans soon put into the public domain his TheNet source code (the program in the form of the language it was written in). Public domain software is free for the taking. TheNet nodes quickly began to appear.

Net/ROM nodes continued to appear, but much more slowly. Still, it came as a shock to many people when Ron suddenly accused the people at TheNet of stealing his program.

How Cloned?

Think for a moment about the idea of cloned computers. Dozens of computer manufacturers—Kaypro, Tandy, NEC, Leading Edge, Standard, Franklin, etc.—produce models that all appear to be exact copies of IBM computer systems in what they do. IBM may not be happy about these clones, but they don't often make accusations of theft. What moves Raikes then to claim theft over a single ROM program, when IBM doesn't complain about a whole cloned computer system?

The answer lies in how the product was cloned. There are two principal ways to clone hardware and software—independent development and reverse-engineering. To understand how they differ, you must understand the meaning of configuration and specification. Configuration is the way a computer, or program, performs a given spec. The spec is the range of functions a product can perform given a particular user interface. Often, the spec of a product is called its "look and feel." There are often many configurations that can carry out the same spec. For an analogy, 1 + 2 + 3, 2 + 2 + 2, and 1 + 1 + 4—three different summing groups—all give the same sum of 6.

In the case of independent development, a developer notes the specifications of a product he wants to clone. He then puts together a development group of programmers and engineers who are "untainted," that is, they have no knowledge of the inner workings of the product to be cloned. In hardware and software development, there are a vast number of ways to design a product to meet the same specifications. There's virtually no chance that an independent development team will come up with the same configurations as that in the clone. (There are other "look and feel" issues which can complicate legalities even further, but the preceding is enough background to understand the issue facing us in ham radio today). Independent development is a legal approach, the one performed by the PC clone manufacturers.

To "reverse-engineer" means to copy part or all of the original product configuration. In the case of software, this means to simply look at the program or mechanically copy it onto your own distribution device, such as a floppy disk or ROM. If the original product is copywrited, this is strictly illegal. It is still illegal if the clone is a modification of the copywrited original product. The point is that it is illegal to use the original product's configuration in any way, even as a base for a new program.

Back To Net/ROM

Ron Raikes accuses Hans Giese DF2AU of reverse-engineering his product. He first sought legal counsel, but the cost of an international copyright infringement lawsuit against a group in Germany (Hans Giese's NordLink Group) would be a crushing financial blow to a small development firm like Software 2000. Ron then brought his story to fellow amateurs, which sparked a raging debate, especially in the Hamnet forum of CompuServe, an on-line information service.

THE INVESTIGATION

Why Look Into It?

Ham radio is becoming more and more computerized. Contemporary PLL rigs have

a large digital component. There are many, many software programs on disk and cartridge for your ham shack. The future of ham radio is very much tied to the future of computing. A great deal of the stuff that's produced is public domain software, but much of it, especially the more user-friendly software, is commercially developed. If the developers see that they cannot trust the ham radio community, they may deal themselves out of our market. This, in addition to amateur radio's tradition of ethics and self-policing.

Interview With DF2AU

The first step is to determine whether or not the TheNet chip was developed by independent development or by reverse-engineering.

In a telephone interview, Giese stated that he felt forced to make a clone version of Net/ROM because no source code was supplied with the product, and there were some bugs in the first version. Using an analogy, Hans explained: "You have a radio which has spurious emissions. It came without a circuit diagram. You make such a diagram, and say this is it, this is how to repair the radio."

Hans appeared to waffle on the question of whether or not he disassembled the Net/ROM chip. At first he denied having copied Ron's program by looking at the ROM with a disassembler, one of the tools of software programmers. "We did a new source code in C and made it available; it was not disassembly." Later in our interview, however, Hans said, "I disassembled some part of it." When I repeated that to him for clarification, he considered for a long moment, and then reiterated that disassembly was not part of the process. This ambiguity may or may not be due to the language difference.

After I commented on the extreme similarity of the two ROMs, Giese continued, "If he's (Ron Raikes) going to charge sixty-five bucks for a ROM, he has to live with being cloned. Let's not call it revenge. Let's say that I am an angry consumer. Normally, we would have made TheNet differently, but for Ron's high-nosed attitude."

Raikes' "high-nosed attitude," according to Giese, is his refusal to release the source code for Net/ROM when it was first marketed. Yet, bear in mind that it's unusal for a company to release the source code for one of their copywrited products, for the obvious reason that it leaves the product open for bootlegging.

Government, Business Stance

I spoke to Ralph Haller, the FCC's Chief of Rules and Regulations. He was aware of the controversy, but maintained that the FCC is unable to act without a court ruling. I then turned to the Tucson Amateur Packet Radio (TAPR) organization for guidance. The present head of TAPR, Andrew Freeborn NØCCZ, said, "I encourage the FCC to resolve it. The only way we as an organization can come out and say anything would be because of a lawsuit." They will not investigate because they will not pull their own programmers from development work on other projects. Andy explained that TAPR is not a big organization, but just a handful of people employed full-time in development.

Who Can Act?

Clearly, investigation had to go on at the individual level, and it has. In January 1989, Thomas Allen WA6IGY, an experienced C programmer, compared copies of the Net/ROM and TheNet source code. Allen obtained the Net/ROM source code from Ron Raikes, and a copy of the TheNet source code. He created a cross-reference table of routine names and file names in each program listing. He then compared the two source codes with the following results, quoted with his permission:

"There are 234 Net/ROM routines in Version 1.3. Of . . . 232 routines in Net/ROM, all are duplicated in TheNet with identical numbers and types of passed parameters. In every TheNet C function, an identical number and type of auto variable are allocated in the stack in the same order as they are in the corresponding Net/ROM routine." After many such examples, Tom reported: "It is my conclusion . . . that TheNet is not an original development, but rather a direct copy of Net/ROM . . ."

Some people have questioned whether or not the source code Ron has been handing out to people is the real source code. This was easy enough to verify, which Eric Williams WD6CMU did. Eric keyed in the Net/ROM source code obtained from Raikes and successfully compiled it into a Version 1.3 chip.

Further Investigation

I then called on two independent computer consultants, experts in the C language, to verify or dispute Tom's claims. Each consultant was sent both TheNet and Net/ROM source code and a copy of Tom Allen's report. Neither is a ham radio operator.

Both independently arrived at the same conclusion: Tom Allen's report is correct in detail and in its conclusion.

One of the consultants, Jerry Whitnell (President of BC Software), said: "The reasons I agree with Tom are that if you look at both sources with an eye toward what kind of code a compiler would generate, you would have to conclude they are the same . . . . If they were developed separately, even from the same definition, I would expect to see a lot more differences than I do." The source codes varied only by some variable names.

The other consultant, Phil Reed, an internal computer consultant for Clark Equipment, stated: ". . . It is impossible for me to believe that two people could come up with the same routines through this much stuff . . ."

What To Do?

Amateur radio is self-policing; that's always been our credo and to our credit. In the absence of an expensive lawsuit, it must be up to each individual ham to examine the evidence and to draw their own conclusions.

We spoke to one ham, Tadd Torborg KA2DEW, who runs about 100 TheNet nodes in the New England region. He told us he would soon be in contact with Raikes. If Ron can show him proof that the printed source code from Software 2000, which appears identical to TheNet's alleged copy, actually produces a production Net/ROM chip, he will pull down all of his TheNet nodes. He may or may not bring them up as Net/ROMs. There are many alternatives. This is the sort of action that all affected hams should be considering.

There will probably not be a formal court case because of the vast expense of such an undertaking. In this case, the ham radio community itself must serve as its own court. Are we up to abiding by our own verdict? 73

Bits of Background

There are three essential hardware ingredients to a packet station—a transceiver, a microcomputer, and a data controller that interfaces (i.e. patches together) the first two. Data controllers are responsible for converting the information that flows between the micro and the rig to forms each can accept. A telephone modem serves essentially the same function as a data controller. Data controllers require some intelligence to perform their functions, and so are computers in their own right. Data controllers dedicated to modulating/demodulating just packet radio data are most often called Terminal Node Controllers (TNCs).

Like all computers, TNCs require "software"—one or more computer programs—to know what to "do." These are instruction that are stored on a "chip" (IC). Since these programs are vital to the TNC operation, and typically never need alteration, they are stored on a Read Only Memory (ROM) chip. A ROM chip is an IC from which you can "read" (draw from) the information stored within, but to which you cannot easily "write" (add/alter information).

One of the many unique functions of packet radio is its ability for different packet stations to time-share a frequency. It can do this successfully because a packet radio system monitors a channel and transmits only when it senses a clear channel. Packet stations that act as relays for packet signals are called digipeaters (digis). They act like repeaters, except that they operate on only one channel (simplex). When a packet to be relayed arrives at the digipeater, the digi stores the packet into a buffer and keeps it there until the digi doesn't detect any activity on the channel. At that point, it transmits the packet.

This is a neat concept in itself, for you could theoretically send a packet anywhere, provided there are digis en route. A packeteer, however, still had to know the route and specify all the intermediate digi addresses in their correct order when sending a packet to a destination address. This can be very cumbersome for long-haul transmissions. Fortunately, much of the routing has been automated through systems such as Net/ROM, which you can read about further in the article . . . .

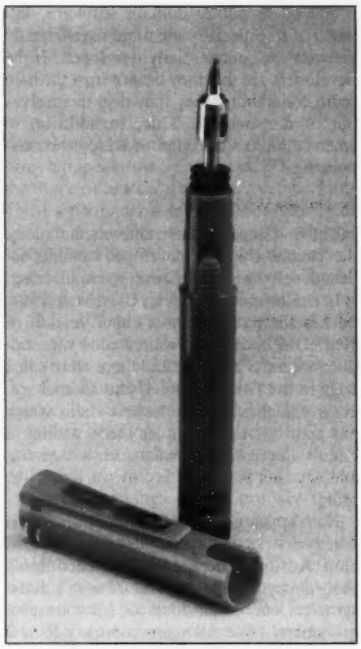
. . . de NS1B

73 Review *by Larry R. Antonuk WB9RRT*

Portasol Butane Soldering Pencil

An easy-to-use version of a much-abused tool.

GC-Thorsen
1801 Morgan Street
Rockford IL 61102
(815) 968-9661
Price Class: $50



The most abused tool in every technician's toolbox has certainly got to be the soldering iron. Normally crammed in the bottom drawer, sporting a frayed cord and a worn-out tip, the lowly soldering iron also takes a great amount of verbal abuse. It takes too long to heat up. The tip is too large/small/etc. Not enough wattage. Always rolls off the table. The list goes on and on.

It's no surprise, then, that most hobbyists (and some professionals) show a definite lack of interest when buying a new soldering pencil. Most irons are bought without much careful shopping or consideration, and the users tend to pay the price in frustration. It's not uncommon to see someone using a $2.99 iron on a $2500 ham rig, and then wondering why those cheap PC board traces keep peeling up.

New on the market for 1989 is a product destined to change all of that—a butane version of our old friend. The Portasol butane soldering pencil system is efficient, powerful, versatile, and even fun to use. The Portasol is about the size of a cigar tube, and comes with a pocket clip on the cap. The cap pulls off, and contains a flint-type striker for lighting the unit. The deluxe version includes a plastic carrying case and an assortment of tips. In addition to one large and one small tip, the kit comes with a torch tip and a heat-shrink tubing tip. The torch, although small, is useful for heating and bending small diameter rod, and works quite well for soldering connectors on Heliax™ cable. The heat-shrink tip is a flameless device that works wonders on tubing (the heat gun could become a thing of the past). A tip-cleaning sponge and an iron holder (that "third hand") round out the kit.

Soldering with Gas

The first thing that you'll notice after you "fire up" the iron is that its novelty makes using this tool enjoyable, even fun. The advantages of soldering with gas—not having to wait long before soldering, not needing to find an outlet, or get tangled in the cord—all make this a very friendly tool.

Once lit with the built-in igniter, the Portasol comes up to solder-melting temperature in about thirty seconds. The valve on the base of the unit acts as a heat control, and a sliding button on the side of the unit acts as an on-off control. Once the tip is up to heat, the iron can be set to a lower "idling" temperature. At this setting, you can expect about two hours of burn time. The tank is contained in the handle of the unit, and can be refilled with the type of canister sold at most drugstores (used for refilling cigarette lighters). These canisters were available in my area for about two dollars, and I estimate that you can get ten to fifteen charges per canister.

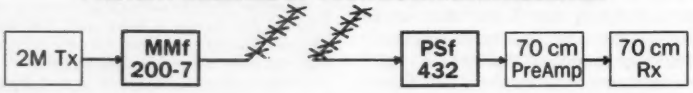
The small tip works well on PC board repair, but how hot does the big tip get? The only answer to that lies in the answer to the first question out of every radio man's mouth, "Yeah, but does it solder PL-259s??" It sure does, and has enough capacity to do the job well. It fell short only one occasion, which happened to be outdoors on a windy New Hampshire winter day. (We needed a good excuse to come inside, anyway.)

The Portasol Butane soldering system comes as a kit for $50, or as a one-tip iron for $30. Considering that most professional bench irons start at fifty dollars, the Portasol is quite a bargain. As a matter of fact, if you do only intermittent bench soldering, the Portasol could easily replace a bench iron.

The Portasol is built in Ireland and is distributed in the US by GC-Thorsen. The basic unit, less spare tips and carrying case, is also available from Radio Shack.

OSCAR MODE-J FILTERS

PREVENT DESENSE OF YOUR DOWN-LINK RECEIVER



MMf200-7 (usually sufficient)	$55.00	PSf432 (for extra protection)	$95.00
I.L. @ 145 MHz	0.5dB	I.L. @ 435 MHz	0.1 dB
Loss @ 435 MHz	40 dB min	Loss @ 145 MHz	70 dB typ

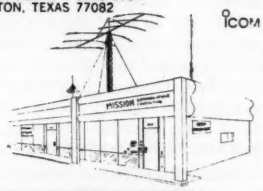
Send 75¢ (3 stamps) for detailed specs on all VHF & UHF products. Shipping FOB Concord, MA
PRICES SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

SI SPECTRUM INTERNATIONAL INC. (508) 263-2145
P.O. Box 10845, Concord, MA 01742, USA
Come see us at Dayton Booth #66 &67

CIRCLE 183 ON READER SERVICE CARD

MISSION CONSULTING, INC.
MISSION COMMUNICATIONS
11903 Alief-Clodine Suite 500
HOUSTON, TEXAS 77082

ICOM



WE HAVE EXPANDED AND NOW STOCK
MANY NEW PRODUCTS. WE CARRY:
AEA, ALINCO, AMECO, AMP SUPPLY, APHA DELTA, ANTECO, ARRL, B&B INSTRUMENTS, BARKER & WILLIAMSON, BENCHER, BOMAR, BUTTERNUT, BEE, CUSHCRAFT, COMMUNICATION SPECIALISTS, CRB RESEARCH, DAIWA, DIAMOND, HENRY, HUSTLER, HAM RADIO, INTL. CRYSTAL, INTL. WIRING & CABLE, KANTRONICS, KACHINA, KENPRO, KDK, KLM/MIRAGE, LUNAR, LARSON, MOBILE MARK, MFJ, NEUTECH, NCG, NYE, PERIPHEX, QST, RF INDUSTRIES, RADIO PUBLICATIONS, RADIO AM. CALLBOOK, SAMSON, SPI-RO, SMILEY ANTENNA, SANTEC, SYN. TEXTILES, *73*MAG, STANDARD, TAD, TEN-TEC, VALOR, VECTOR, GORDON WEST, WELZ, YAESU, AND ICOM.

In house service available. (713) 879-7764
Just write, or give us a call! Telex 166872 MCON UT

CIRCLE 187 ON READER SERVICE CARD

"How Does Your Remote Base Stack Up?"

Now it's easy to add a multi-band remote to your repeater.

Your repeater can link any frequency on up to six bands with ACC's new interface to the ICOM IC-900 Super Multi-Bander System.

Our new FC-900 Interface connects your ACC controller to the ICOM band units (the ICOM fiber optic controller and interface aren't needed). Add new bands to your system by just adding band units. And best of all – everything just plugs together!

If you've built remotes before, you'll appreciate the simplicity – and the performance. If you haven't, now is the time to add a new remote base or linking system to your repeater.

Extend the range of your repeater, link to other repeaters for emergency and public service activities, and benefit from the elevation of your repeater site for all bands. From ten meter DX to 1200 MHz linking – and everything in between.

ACC pioneered frequency agile remotes and links on repeaters years ago. Now we've made it easy. One more reason that ACC is the right choice for your repeater system.

Write or call for more information on ACC's line of repeater controllers, voice storage units, and the new FC-900 Interface.

acc advanced computer controls, inc.

2356 Walsh Avenue, Santa Clara, CA 95051 (408) 727-3330

CIRCLE 1 ON READER SERVICE CARD

INTERFERENCE?

★ Interference Location
★ Stuck Microphones
★ Cable TV Leaks
★ Security Monitoring

★ VHF and UHF Coverage
★ Computer Interface
★ Speech Synthesizer
★ 12 VDC Operation

New Technology (patent pending) converts any VHF or UHF FM receiver into an advanced Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Uses four omnidirectional antennas. Low noise, high sensitivity for weak signal detection. Call or write for full details and prices.

DOPPLER SYSTEMS, INC. P.O. Box 31819 Phoenix, AZ 85046 (602) 488-9755

CIRCLE 15 ON READER SERVICE CARD

NATIONWIDE CONSUMER ANNOUNCEMENT:

from COMB Authorized Liquidator

Genuine BEL Radar Detector

Just $29

C.O.M.B.'S AUTHORIZED PRICE

That's right—SAVE OVER 75% on famous MICRO-EYE performance!

BEL's Compu-Heterodyne Model 864 Radar Detector warns you of radar from ahead or behind. Sensitive Micro-Eye circuitry uses a microprocessor to detect distant K- or X-band radar. This unit is **so popular,** it has sold out in the past. However, C.O.M.B.'s persistency paid off—we've secured a new inventory—priced $90 off list!

- Dual LEDs and Audio Alarm Alert You
- Duration and Frequency of Beeps and Soft Clicking Signals Increase as Radar Gets Closer
- Mounts on Dash or Sun Visor
- Compact Size: 1¼"H x 3¼"W x 4½"D
- Built-In Test Sequence

1-Year Limited Factory Warranty

Mfr. List Price $119.95

C.O.M.B. Authorized Price $29

Item H-3943-7410-947 S/H: $5.00 ea.

Check local laws for possible use restrictions.

COMB Authorized Liquidator
1405 Xenium Lane N/Minneapolis, MN 55441-4494

Send ___ Radar Detector(s) Item H-3943-7410-947 at $29 each, plus $5.00 each for shipping, handling. (MN residents add 6% sales tax. VA residents add 4.5% sales tax. Sorry, no C.O.D. orders.)

☐ My check or money order is enclosed. (No delays in processing orders paid by check.)

PLEASE CHECK: ☐ VISA ☐ ☐ ☐

Acct. No. _____ Exp. ___/___

PLEASE PRINT CLEARLY

Name _____

Address _____ Apt. # _____

City _____ State _____

ZIP _____ Phone (___) _____

Sign Here _____

QUANTITIES LIMITED! ORDER NOW!
Toll Free 1-800-328-0609
Use your credit card. Lines open 24 hours a day, 7 days a week.

The 220 MHz DMOS Linear Amplifier Project

Follow-up to January's 220 MHz transverter project.

by Robert E. Bloom W6YUY

For those dedicated home-brewers who have just gotten warmed up on the transverter project (Jan. '89 *73*), here is another item to apply the iron to: the DMOS linear power amplifier.

Chassis

This amp is constructed on a 10" x 3¾" x ⅝" radiating fin heat sink. The linear output of this amplifier exceeds 60 Watts RMS on CW power. The heat sink is somewhat larger than required, and runs quite cool. The amplifier is contained in an attached box made from double-sided material 1-½" deep. About a third of the box is empty. If you plan to make this state-of-the-art, cool linear amplifier, you may want to use a different heat sink.

Basic Circuit Description

The linear power amplifier package consists of two stages: a poly core F-1202, 20 Watt MOS power driver and a M/A COM PHI DU-1260T UMOS 60 Watt amplifier. These are both 12 volt transistors, but you can operate them at much higher voltages if you observe the specifications. Both of these companies manufacture a variety of units, from 2 Watts to 200 Watts, in frequencies to 1.4 GHz. See the sidebar for a description of MOS power.

DMOS Power Amplifier

The only similarity to printed circuitry in the amplifier unit was the removal of four short ¼" wide strips of foil at the input and output of the two DMOS transistors. It probably was not necessary to do it this way but I wanted the strips to look inductive, such as in an L-network. I didn't know at the time that all but the input circuit of the driver was going to be heavily loaded with Unelco or Underwood low-inductive capacitors. The placement of these capacitors is responsible for the amplifier's outstanding purity and stability. The relatively narrow bandwidth or selectivity of a tuned design compared to a broadbanded design, along with the purity of the linear RF output, made output filters unnecessary.

Despite several tuned stages preceding the UMOS amplifier, I thought it prudent to include a seven-segment filter at the input of the amplifier driver stage. Why not put it at the output? This is because silver mica "dog bone" capacitors will not handle the 60 Watts of RF current normally available. If you have the larger, more specialized capacitors required, you may wish to put them in your unit.

It's best to lay out the filter in a zigzag fashion so the inductors don't couple with each other. The best place for the filter is along the side panel, allowing space between the input gate of the transistor and the BNC input coaxial bulkhead connector. If you want the filter in the output end with higher current capacitors, you will probably have to compromise space with the antenna connector and the receiver BNC connector on the wall at that end of the unit.

Strip Line Technique

Small strips of single-sided PC board material are used as input and output inductors to the power FETs. The small strips of PC material not only make the inductance for the L-network, but also allow for the placement of non-inductive capacitors and other components.

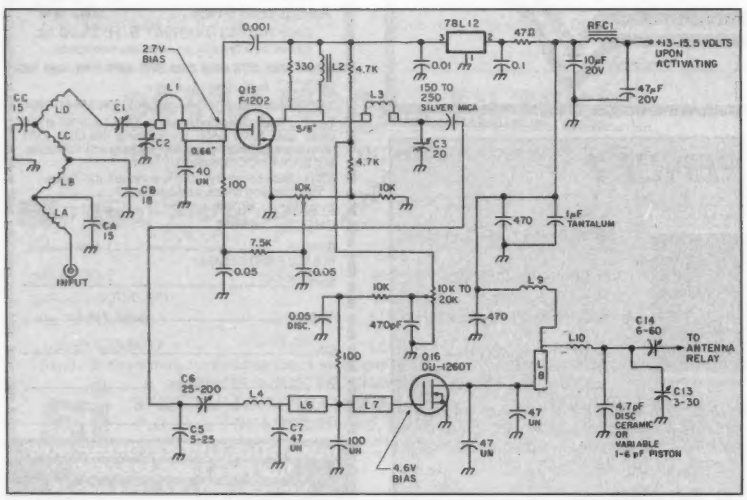


Figure 1. Schematic for the 220 to 225 MHz D-MOSFET linear power amplifier.

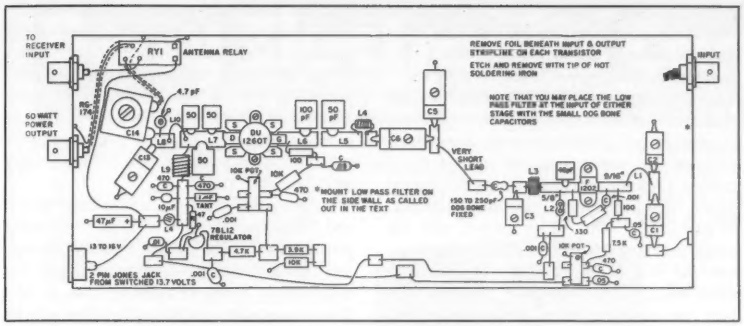

TO RECEIVER INPUT
RY1
ANTENNA RELAY
REMOVE FOIL BENEATH INPUT & OUTPUT STRIPLINE ON EACH TRANSISTOR
ETCH AND REMOVE WITH TIP OF HOT SOLDERING IRON
INPUT
60 WATT POWER OUTPUT
NOTE THAT YOU MAY PLACE THE LOW PASS FILTER AT THE INPUT OF EITHER STAGE WITH THE SMALL DOG BONE CAPACITORS
DU 1260T
VERY SHORT LEAD
*MOUNT LOW PASS FILTER ON THE SIDE WALL AS CALLED OUT IN THE TEXT
150 TO 250pF DOG BONE FIXED
78L12 REGULATOR
13 TO 16 V
2 PIN JONES JACK FROM SWITCHED 13.7 VOLTS

Figure 2. Parts placement for the D-MOSFET linear power amplifier.

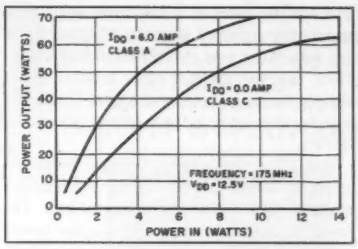


Figure 3. Input power to output power chart for the DU1260-T in the linear power amplifier.

Class A or AB bias is applied through a resistor to the gates of the driver and final transistors. Each stage has its own bias level pot. You will notice that all B+ lines are well filtered as a precaution against any unwanted signals coming in on the voltage line. This is so throughout the entire transverter design, so get a good supply of 0.001 disc ceramic capacitors.

As a last precaution, check each RF stage of the transmitter for proper operation in serial progression, keeping all drain voltages disconnected until the preceding stage is working properly. Use a Bird wattmeter or other RF instrument with a small 50Ω dummy load to assure 3.5 Watts output from the transverter proper. Follow the same procedure, using a temporary cable from the output of the amplifier driver stage. Make sure that, before connecting drain voltage to any of the three MOS power transistors, the three bias pots are set to minimum voltage. Eventually, the bias voltages will be close to 6.5 V to Q-14 (DV-1205S), 2.7 V to Q-15 (F-1202), and 4.6 V to the Q-16 (DU-1260). The final transistor puts out 60 Watts plus. The power amplifier can operate very safely with 13.5 to 20 volts at the drain with higher output power from the higher voltage.

The bias source voltage is regulated with a small 12 volt regulator. The purpose here is to retain the set bias voltage should you wish to master-power the system with increased voltage. The bias voltage sets the amount of drain current; an increase in drain voltage does not affect the drain current setting, but you will increase the output power by virtue of the increased voltage.

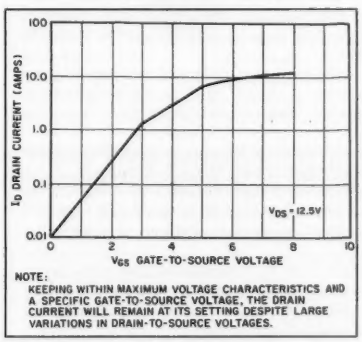

I_D DRAIN CURRENT (AMPS)
V_{DS} = 12.5V
V_{GS} GATE-TO-SOURCE VOLTAGE
NOTE:
KEEPING WITHIN MAXIMUM VOLTAGE CHARACTERISTICS AND A SPECIFIC GATE-TO-SOURCE VOLTAGE, THE DRAIN CURRENT WILL REMAIN AT ITS SETTING DESPITE LARGE VARIATIONS IN DRAIN-TO-SOURCE VOLTAGES.

Figure 4. DU-1260T transfer characteristics.

Circuit Comments

The physical size of the linear power MOSFET amplifier is mainly related to the size of the heat sink. The one I prefer has four fins on each edge. I suggest that you write to *American Electronics Co., 173 E. Broadway, Greenwood, IN 46142* and ask for their parts catalog, which costs $2.

I placed the low-pass filter for the DMOS power amplifier at the driver input. The small dog bone capacitors safely handle the RF current at this point. Though I could have placed it at the input to the final DU-1260T stage, I reasoned that any garbage most likely would have been generated ahead of these stages. The number one contender is the 2N3866 stage, but it appears clean. It is better

220 to 225 MHz D-MOSFET Linear Amplifier

Parts List

Q-1	F-1202 20 Watt gold metalized power FET transistor, single-ended from Polycore RF Devices, 1107 Tourmaline Drive, Newbury Park CA 91320.
Q-2	DU-1260T N-Channel MOSpower FET from M/A COM PHI, Inc., 1742 Crenshaw Blvd., Torrance CA 90501.
1	Jones 2 prong male and female bulkhead for source voltage input.
1	8 pin mike type male bulkhead jack from Philmore Mfg. Co., Inc., Inwood NY 11696.
1	8 pin mike type female plug Philmore No. 1700, $2.95 list. Both plug and jack also available from Radio Shack, Henry Radio, and Hosfelt Electronics (female) P/N MC8P, $2.50. Male chassis bulkhead P/N 8PMCS.
1	Cynch Barrier block for input power (Hosfelt); Heat Sink (Hosfelt and Pete Smith)
S-1	Miniature triple-pole single-throw Switch
RL-2	Control Relay single-pole double-throw 12 volt 40 mA coil minimum, coil resistance 250ΩRL-3Tx Plus Power Control Relay 100–270Ω field coil, 4 sets of double-throw contacts set parallel to handle 10 amperes
RL-1	12 volt Antenna Relay single-pole double-throw, with quality contacts and reasonable low capacity between contacts; Field Coil between 100–700Ω Pad Gate and Drain Pads for F-1202. 1/16" Single-sided PC material 1/4" wide x 0.66" long and 1/4" x 5/8", respectively
L-6,L-7, L-8	PC Material as above, ¼" wide ⅜", ⅝" and 0.66", respectively.
L-A, L-D	Low-pass Filter Coils 3/16" inside diameter 3 turns
L-B, L-C	Low-pass Filter Coils 3/16" inside diameter 4 turns
CA, CC	Dipped Silver Mica dog-bone capacitors with 500 V test rating 15 pF
CB	As above, 18 pF
RFC-1	3 turns on 6 hole Ferrite Bead FB-43-5111 Amidon
L-1	¾" long #18 Tinned bent into a hairpin ⅓" diameter
L-2	4 turns on BN-43-2402 Amidon Balun Core
L-3	3 turns #20 Tinned 3/16" ID spaced one wire diameter
L-4	5 turns #20 Enameled 5/32" ID Close Wound
L-5	None
L-9	5 turns #20 Enameled 5/32" ID Close Wound
L-10	1 full turn #16 or 18 Enameled ¼" ID
C-1, C-5	2–25 or 3–30 pF 404 series Small Arco Compression Trimmers
C-2	10–80 pF 404 series Small Arco Compression Trimmers
C-3	3–20 pF 404 series Small Arcc Compression Trimmers
C-6	25–200 404 series Small Arco Compression Trimmers
C-7, C-9, C-10, C-11	Underwood or Unelco 47 or 51 pF noninductive capacitors
C-5	As above, but 40 pF
C-8	As above, but 100 pF
C-12	4.7 Disk Ceramic or 1–7 pF piston capacitor
C-13	1" long 420 series 2–3 Arco Compression capacitors
C-14	1" square (two plates) Arco 300M series 6–60 pF variable compression capacitors

to have the filter at a low-level stage than to amplify signals and create a bigger filtering job. As a rule, MOSFET linear amplifiers run far cleaner than bipolar types simply because at elevated signal levels, the bipolar transistor is basically a non-linear device.

For RF amplification, use the following guide to set up the DV-1205S V-MOSFET stage Q-14 in the main transverter unit. The level of drain current and ultimate power output of the stage 4 volts sets up a drain current of 200 mA, while 6 volts sets up 400 mA, and 7 volts sets up 600 mA. If you don't get an increase in power output with increased drain current, you don't have enough driving power to increase the power output of the device. It isn't economical to increase the drain current further. Since this project has three MOSFET linear amplifier stages, set the output levels for only what you require. On the other hand, if the drive is much greater than you need, don't worry about blowing the FETs, since you can't hurt them by overdriving a little.

Test Equipment

In order to align and test the devices described in this article, you need the following test equipment.

1. A stable signal generator or calibrated oscillator and 50Ω adjustable attenuator covering the appropriate RF range.
2. A VHF-range RF vacuum tube voltmeter or a good DC vacuum tube voltmeter with UHF RF probe. (Solid state is fine, too.)
3. An electronic frequency counter covering the appropriate frequency range.
4. A VHF grid dip meter to check coil resonance. (Not absolutely necessary if you follow coil winding data closely, but it can be a real aid.)
5. Capacity bridge to confirm small values of capacity marked, and to set a given capacity in a test circuit. (See *Ham Radio*, March 1980, page 54.)
6. A Bird Model 43 or other power measuring device, and a 50Ω load (termination).
7. A multi-range VOM. It must be capable of reading current to 10 amperes.

Where To Find Component Parts at Reasonable Prices

In this project you will use quantities of miniature plated capacitors, various sizes of compression capacitors, disc ceramic variables and fixed capacitors, and dipped silver micas (dog bone) components. Fixed disc ceramic of 0.001 µF are sprayed around the source voltage lines as bypasses and as both coupling and decoupling circuits. In circuits requiring a degree of stability, use silver mica caps. Johnson 2–12 pF, usually 8 plates total, are used in stable RF circuits. These plated and small, high quality Argo compression types resonate coils.

All powdered iron and ferrite toroidal cores and baluns are available from Amidon Associates. You can buy the 8-pin DIN plug from Kenwood. Get two. The price ranges from $2 to $2.50 each. I bought my crystal from *Jan Crystals, 2400 Crystal Drive, Fort Myers, Florida 33906-9989*. Order series resonance 0.001 accuracy and enclose a schematic diagram of the oscillator circuit.

MHz Electronics Inc., 3802 N. 27th Ave., Phoenix, Arizona 85017 advertises in most ham publications. They also have crystals, transistors, and Unelco non-inductive capacitors for the power amplifier. (Send for a catalog.) Another excellent source for dipped silver mica capacitors, miniature variables, JFETs (15¢), 4067 (25¢) relays, and the small heat sink 2N3866 is *Hosfelt Electronics, Inc., 2610 Sunset Blvd., Steubenville, Ohio 43952*. The 8-pin mike type plug and jack are available from *Henry Radio* and *Radio Shack*.

You will notice full use of tuning capacitors. This could add up to a nice piece of change. Many of the stages in the receiver could be tuned temporarily with a good quality fixed capacitor. Remove the capacitor and measure a digital capacitance bridge, substituting the capacitor with a good quality dipped silver mica. Then compress or expand the coils on the toroidal core until resonance is re-established. This is a mildly complex substitution I have seen described in many publications.

Parts are also available at ham swap meets, and I have som items at very reasonable prices. If you have questions or comments, feel free to write me. Enclose an SASE for a response. Upon completing this project (I wish to emphasize taking your time, step by step), the gratification and pride you will feel cannot be expressed on paper.

Look for the 6 meter transverter project in a subsequent issue of *73* magazine. 73

What Is MOS-Power?

MOS-power FET transistors were developed by the Siliconix Transistor Manufacturing Company more than a decade ago. MOSFET transistors differ from bipolar transistors. They have a closer relationship to the vacuum tube, but are still different. You might ask, "Since they have been with us for over a decade, why haven't we heard more about them?" The answer is twofold: (1) Low-power VMOS-FETs are widely used in industrial pulse applications, and (2) The manufacturing industry of these devices is still working through the maze of problems relating to high-level production with power FETs.

We do have an early generation of CMOS transistors and integrated circuit chips. Siliconix, the originator of VMOS power transistors, sold its power MOS division to the M/A COM PHI Corporation located in Torrance, California. Today they no longer produce power FETs.

VMOS and UMOS FETs as described in this project are N-Channel MOS power FETs operating in an enhancement mode. The "V" in VMOS (vertical metal oxide semiconductor field effect transistor) relates to the "V" structure of the gate, where the current has a vertical flow across the short dimension of the chip. The "U" in UMOS is a later truncation of the "V" structure of the chip that allows the transistor to produce higher levels of output power plus a very consistent level of gain over the frequency range.

VMOS or MOS power FETs are high impedance devices (possibly higher than that of the vacuum tube). At low frequencies, they are capacitive devices, rather than inductive, as compared to a bipolar device which is low impedance, and both input and output look inductive. In contrast, the dynamic impedance at the high frequencies is low, but several times higher than the BPT. The bipolar device has a reputation of "thermal runaway." The hotter it gets, the more current it draws; the more current it draws, the hotter it gets, until it destroys itself. The MOS power device has an opposite effect. The hotter it gets, the less current it draws, until it shuts itself off.

Because of the nonlinear gain of a bipolar device (having high beta, or gain at low frequencies) tapering off at the higher frequencies, the beta reaches a level of unity or the cut-off frequency. Therefore, bipolar power transistors are catagorized according to their specific frequency ranges of operation. Should lower frequencies be induced on the source power line, use special circuitry in the power source to prevent the transistor from oscillating and burning up as a result of the higher gain at the lower frequency.

VMOS, on the other hand, have a very flat frequency gain. Usually this response is better than ±1 dB across the range, including the audio frequencies. It is common to see a 175 MHz device used in a broadband 2–30 MHz amplifier, for example. A significant deficiency of the bipolar device is immediately noted as soon as you get out of the small signal level of operation. The bipolar transistor is basically a Class C device and exceptionally nonlinear. To use a bipolar power device in the linear mode, the transistor must be bulldozer-style biased, with a silicon diode somewhere in the voltage divider chain to hold the bias level. Also, the diode must be in contact with the transistor, so that as the transistor heats up and the linear bias point level drifts, the diode will also heat up and reestablish the linear bias point.

In comparison, a MOS-power transistor with its exceedingly high resistance gate circuit can be positively or negatively biased for any class of operation: A, B, C, D, or E, unaffected by heat. In that the gate circuit draws virtually zero current, the impedance of the bias supply is immaterial and will stay exactly where it is originally set.

Most manufacturers state that you cannot destroy a VMOS device by overdriving. Some will not admit to sudden failure in a new design, such as a transient which can punch a hole through the very thin barrie between the gate and source. However, the device will operate safely with infinite SWR to either its input or output—an exceptional characteristic you can be very happy about. All of the manufacturers test their devices with a 20:1 VSWR mismatch and 30:1 is called out on the specification sheet. Sounds like April First!

Maximum junction temperature is specified at 200°C (392°F). Typical power gain of the device is 10 dB across the whole frequency range. I have seen devices specified as low as 7 dB and as high as 14 dB to 1.4 GHz. With these impressive advantages over the bipolar, we can visualize a faster demise for the bipolar transistor than even that of the vacuum tube.

WE SHIP WORLDWIDE

Barry Electronics Corp.

WORLD WIDE AMATEUR RADIO SINCE 1950

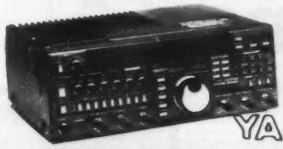
Your one source for all Radio Equipment!

For the best buys in town call:
212-925-7000
Los Precios Mas Bajos en Nueva York
WE SHIP WORLDWIDE!

L. Juli

See You June 4th—HOSARC, Queens, NY
June 28th, Radio Central (Speech), Shoreham, L.I. NY

KITTY SAYS: WE ARE NOW OPEN 7 DAYS A WEEK.
Saturday & Sunday 10 to 5 P.M.
Monday-Friday 9 to 6:30 PM Thurs. to 8 PM
Come to Barry's for the best buys in town.



ONV Safety belts-in stock

ICOM

IC-R71A, 751A, 781, 28A/H, 38A, 48A, Micro2/4, R-7000, IC-765, IC-375A, 275A/H, 3210A, 475A/H, 735, IC-900, IC-228H, IC725, IC448A

YAESU

FT-767GX, FT-757GXII, FT-747GX, FRG-8800, FT-736R, FRG-9600, FT-4700RH, FT-212/712RH, FT-470

SMART PATCH

CES-Simplex Autopatch 510-SA Will Patch FM Transceiver To Your Telephone Great For Telephone Calls From Mobile To Base. Simple To Use. 510SA/510SAII

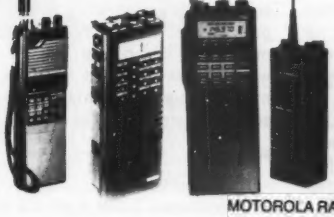
KENWOOD

ANTENNAS
A-S, AES, Cushcraft, Hy-Gain, Hustler, KLM, METZ, Mosley, MODUBLOX, TONNA, Butternut, Multi-Band

TS440S/AT, R-5000, R-2000, TS-940 S/AT, TM 231A/431A, TM-2570A/50A/30A, TR-751A, Kenwood Service Repair, TM-721A, TS-711/811A, TM3530A, TH205AT, TH215A, TM-821A, TM-321A, TS140S, TS680S, RZ-1, TS-790A.

YAESU	ICOM
FT-23/73/33/727R	IC2AT/12AT
FT411-811	IC02AT/32AT
FT-1903/1123	IC2/4GAT
FTH-2005/7005	IC-A2/U16

Landmobile HT's
ICOM: U16, H16, V100, U400
MAXON, MOTOROLA,
YAESU: FTH 2005/2007
UNIDEN, REGENCY, KING,
MARINE ICOM: M5, M55, M700
AVIATION ICOM: A20, TAD



MOTOROLA RADIUS

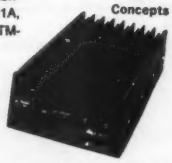
PRIVATE PATCH V, Duplex 8000

TUNERS STOCKED:
NYE MBV-A 3 Killowatt Tuner

Budwig ANT. Products
NEL-TECH DVK-100 Digital Voice Keyer
FLUKE 77, 83, 85, 87 Multimeters

Media Mentors—
Amateur Radio Course

RF Concepts



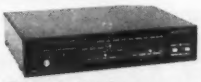
VoCom/Mirage/Alinco
Tokyo Hy-Power/TE SYSTEMS
Amplifiers &
5/8λ HT Gain
Antennas IN STOCK

ALINCO
DJ-500T, DR-110T

Kantronics
UTU, KAM, KPC II, KPC 2400, KPC IV, KAM

MFJ-989C

SHORTWAVE RECEIVERS STOCKED



Computer Interfaces Stocked: MFJ-1270B MFJ-1274, MFJ-1224, AEA PK-88, MFJ-1278, PK-232 W/FAX.

FREQUENCY COUNTERS: 1MHz-1.3GHz

COMMERCIAL & HAM REPEATERS STOCKED. WRITE FOR QUOTES

MICROLOG-ART 1, Air Disk, SWL, Morse Coach

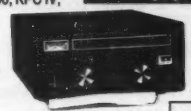
Soldering Station 48 Watts

METRON MA-1000 B STOCKED

AR 900 Hand Held Scanner 100 ch. Covers 27–54, 108–174, 406–512, 800–950 MHz

MOTOROLA AUTHORIZED DEALER
KACHINA COMMUNICATIONS DEALER

AUTHORIZED
SONY
DEALER



Ten-Tec Tuner 229B

COMET ANTENNAS STOCKED

EIMAC
3-500Z
572B, 6JS6C
12BY7A &
6146B

AEA 144 MHz
AEA 220 MHz
AEA 440 MHz
ANTENNAS

BIRD
Wattmeters & Elements In Stock

DIGITAL FREQUENCY COUNTERS
Opto Electronics model 1300H, 0-1300MHz

Long-range Wireless Telephone for export in stock

HEIL EQUIPMENT IN STOCK

SANGEAN Portable Shortwave Radios

BENCHER PADDLES, BALUNS, LOW PASS FILTERS IN STOCK

MIRAGE AMPLIFIERS
ASTRON POWER SUPPLIES
Saxton Wire & Cable, Int'l Wire

OPTO KEYERS STOCKED

Hy-Gain Towers & Antennas, and Rotors will be shipped direct to you FREE of shipping cost.

New TEN-TEC Corsair II, PARAGON, OMNI V

IIX Towers, Antennas, Mobile Radio mounts stocked. Call.

AMERITRON AUTHORIZED DEALER

MAIL ALL ORDERS TO: **BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK CITY, NY 10012 (FOUR BLOCKS NORTH OF CANAL ST.)**

New York City's LARGEST STOCKING HAM DEALER
COMPLETE REPAIR LAB ON PREMISES

"Aqui Se Habla Espanol"

BARRY INTERNATIONAL TELEX 12-7670
MERCHANDISE TAKEN ON CONSIGNMENT FOR TOP PRICES

Monday–Friday 9 A.M. to 6:30 P.M. Thursday to 8 P.M.
Saturday & Sunday 10 A.M. to 5 P.M. (Free Parking)

IRT/LEX-"Spring St. Station". **Subways:** BMT-"Prince St. Station". IND-"F" Train-Bwy Station"
Bus: Broadway #6 to Spring St. Path-9th St./6th Ave. Station.

COMMERCIAL RADIOS STOCKED: ICOM, Motorola, MAXON, Standard, Yaesu. We serve municipalities, businesses, Civil Defense, etc. Portables, mobiles, bases, repeaters...

ALL SALES FINAL

We Stock: AEA, ARRL, Alinco, Ameco, Ameritron, Antenna Specialists, Astatic, Astron, B&K, B&W, Bencher, Bird, Butternut, CDE, CES, Cushcraft, Daiwa, Eimac, Henry, Heil, Hustler, Hy-Gain, Icom, KLM, Kantronics, Larsen, MJF, J.W. Miller, Mirage, Nye, Palomar, RF Products, Saxton, Shure, Tempo, Ten-Tec, TUBES, Yaesu, Vibroplex, Duplexers, Repeaters, Scanners, Radio Publications, Uniden, Kenwood, Maxon, RFC.

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
HAM DEALER INQUIRES INVITED PHONE IN YOUR ORDER & BE REIMBURSED
COMMERCIAL RADIOS stocked & serviced on premises.
Amateur Radio Courses Given On Our Premises, Call
Export Orders Shipped Immediately. TELEX 12-7670

FAX: 212-925-7001

73 Review

by Bill Clarke WA4BLC

The MFJ Differential-T Antenna Tuner

MFJ Enterprises, Inc.
PO Box 494
Miss. State, MS 39762
601-323-5869
800-647-1800
Price Class: $240

A simpler, surer tuner.

Over the years, various configurations have appeared on the market and in magazine construction articles. Each was alleged to be an improvement over all the others. Some may have been, but the majority just plain worked, at least after a fashion.

Antenna tuners can be thought of as variable transformers that compensate for differences between your antenna's actual RF impedance and the impedance your transceiver would like to see at its coax connector. They are the great equalizers in the game of reducing the SWR seen at the rig.

In manual tuners, the operator must make manual adjustments to controls on the antenna tuner for it to do its job. Generally, tuner adjustment consists of selecting an appropriate inductance from a multi-position switch and adjusting two variable capacitors until the SWR indication at the transmitter is at 1:1 (or as low as you can get it). SWR is indicated by a meter that must be switched between forward and reflected power to obtain comparative readings.

New Version

A few months ago, MFJ introduced the Model 986 Differential-T Antenna Tuner. It is a 3 kW unit, providing very simplified (only two controls) broadband tuning and incorporates all the RF output metering you'll usually ever need.

This tuner uses a single differential variable capacitor and a roller inductor in a T-Network circuit. The usual tuner configuration consists of two variable capacitors and a switch-selected inductor in a Pi-network. The first obvious improvement on this tuner is that there is one less variable control for the operator to adjust. Merely crank the variable inductor and turn the capacitor control until the SWR is maximally dipped.

Photo B. Rear panel provides feedline, ground, and 12 volt DC connectors.

A cross-needle SWR meter is built into the unit, giving simultaneous readings of forward and reflected power. A novel inclusion is a peak reading meter circuit for SSB power output. This is a feature many SSB operators want. Before now, that meant the purchase of a separate meter costing as much as $300.

Photo A. Front view of the MFJ-986 showing the two tuning controls, antenna selector switch, and the cross-needle meter.

Features

The Model 986 has:

- Continuous 3 kW from 1.8 through 30 MHz.
- A dual-range (200/2000 Watts) back-lighted cross-needle meter providing SWR, power, and peak reading functions.
- A 6-position ceramic switch allows selection between two coax feeds, a balanced line, or a dummy position (which could be used for a bypassed antenna or dummy load).
- An internal balun for balanced feedlines.
- Small size (10.75" x 4.5" x 15.0").

Inside the Model 986

Before operating the MFJ-986, I removed the covers. Inside I found a large roller inductor with 62 turns on it, with an attached belt-driven turns counter. The capacitor is of high quality construction with adequate spacing for all legal ham output power (and then some). The antenna switch is ceramic and the balun is constructed of two stacked toroids with windings positioned in a manner that should preclude any flash-over problems. Soldering and mechanical work shows itself well, with no obvious defects or poor quality workmanship noted.

Use

The instruction manual includes a small chart for preliminary settings for each band. Using the recommended settings, I tuned my 75 meter loop for 3947 kHz. Tuning was done by turning the roller inductor crank until the counter indicated 046. I then applied a little power and continued inductor adjustment until I located the lowest reflected power indication point. Afterwards I adjusted the capacitor for further reduction. I then fine tuned with these two controls. Total time for the first tuning was nine seconds. I then logged the capacitor setting from its vernier scale and the inductor setting from the inductor's counter. This information is good as a starting point when retuning the same antenna system for the same resonant frequency later on.

I then tuned the same antenna for each ham band. There were no problems and all settings were logged. Using the loop has presented a problem for my other tuner on 10 and 15 meters, but the MFJ-986 tuned it with no problems.

The last operational test was to reset the tuner for each band per my notes based on the previous settings. The unit proved to be very resetable, although some fine tweaking was needed on 75 and 160 meters.

Varied Comments

The turns counter is relative only, but it's completely accurate for logging and resetting. Having the built-in cross-needle forward/reflected meter is a real advantage over other tuners. The peak reading meter is ideal for those of us attempting to run a full gallon.

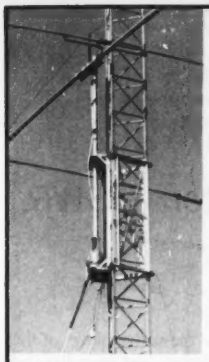
The antenna selector switch should be self-grounding. As it's set up, feedlines not in use are not grounded.

Due to the design of the differential-T circuit, it is possible to get a low SWR at only one combination of the controls. No more worry about too much inductance.

Highly Recommended

Pricewise, the unit is a bargain. You get a cross-needle meter that includes simultaneous forward/reflected indications and selectable peak reading, an antenna selector switch, and a 3 kW tuner all in one box. Yet the unit sells for over $100 less than its nearest competition, which is the MFJ-989B.

Do I recommend this tuner? Yes! It is economical, solid, and easy to use. 73



SAVE TIME and MONEY with THE HAZER

Bring things down for safety and convenience.

Never climb your tower again with this elevator system. Antennas and rotator mount on HAZER, complete system trams tower in vertical upright position. Safety lock system operates while raising or lowering. Never can fall.

Complete kit includes winch, 100 ft. of cable, hardware and instructions. For Rohn 20 and 25 G Towers

Hazer 2– Heavy duty alum. 12 sq. ft. load	$311.95 ppd.
Hazer 3– Standard alum. 8 sq. ft. load	$223.95 ppd.
Hazer 4– Heavy galv. steel 16 sq. ft. load	$291.95 ppd.

NEW for ROHN 45 and 55 Towers

Hazer 8-Heavy duty galv. steel 16 sq. ft. load	CALL
Ball Thrust Bearing TB-25 for any of above	$64.50 ppd.

Send for free details of aluminum towers specifically engineered for use with the Hazer. Two sizes; M-13 (13" wide) and M-18 (18" wide). All bolted construction, no welds. Easy to install hinge base, walk up erection. Complete tower UPS or air freight shippable. Pre-assembled or kit form.

Satisfaction guaranteed. Call today and charge to Visa, MasterCard or mail check or money order.

GLEN MARTIN ENGINEERING INC.
Rte 3, Box 322
Boonville, MO 65233
(816) 882-2734 FAX 816-882-7200

CIRCLE 72 ON READER SERVICE CARD

VISA ICOM MasterCard

VHF COMMUNICATIONS

FEATURING W2DRZ 902 MHz TRANSVERTER. NOW ONLY $299
FREE WITH PURCHASE 140 MHz 3W ATTENUATOR A $49 VALUE
DEALER INQUIRIES INVITED
ICOM, AEA, LARSEN, VAN GORDEN, VIBROPLEX, NYE-VIKING, FALCON COMM, LEADING EDGE, ARRL PUBLICATIONS, KAGLO, HAMTRONICS, SINCLAIR ANTENNA, AMP SUPPLY

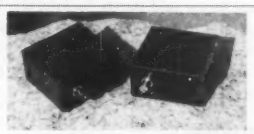
280 Tiffany Ave.
Jamestown, New York 14701

Western New York's finest amateur radio dealer.
PH. (716)664-6345

IRON SLEEVE Only $19.95

Place a hot soldering iron in your toolkit without having to wait for it to cool! Saves wasted time!

Insulated carrier protects while it absorbs the irons heat. Fits most popular soldering irons. 11" long tube 1.5" in diameter.



WINDOW COUPLER

Run your coax from inside to outside through the glass! No Holes! No Pinched Coax! No Drafts! 2MTR & 440 1.5:1 SWR with loss than 3db loss. 10MHz bandwidth and rated for 25 watts. Bonus mount to window with tape. Specify BNC or UHF/SO239 conn.
WPO-VHF (140-160MHz) $59.95 WPO-UHF (440-460MHz) $59.95
SCANNER/TV version 60-800MHz RX only, 8db loss,"F" connectors.
WPO-TV $49.95

NEW PRODUCTS!!

VAK-TENNA

IDEAL FOR APARTMENTS!
For 2mtr & 220 or Braxtons. Mounts to glass with suction cups. Collapsible dipole extends to 79". With 15' coax and choice of BNC, PL259 and other connectors. $39.95 MORE MODELS AVAILABLE!

SIGNAL INTENSIFIER *Receiver Preamplifiers*

Assure the best reception. MANY MODELS AVAILABLE, including the following:
RFP-40 1-1300MHz 15db gain 2.0db nf. 115VAC powered (DC avail +24) receive use only. $69.95 (BNC/SO239)
RFTR-SSB 10mtr & CB 13db gain. 12VDC powered (AC avail) for use with transceivers under 50 watts. $64.95
RFTR-M for VHF MARINE $99.95

TAPE SAVER

Scanner Recording Interface switches your remote controlled cassette recorder on and off to record during activity only. $49.95

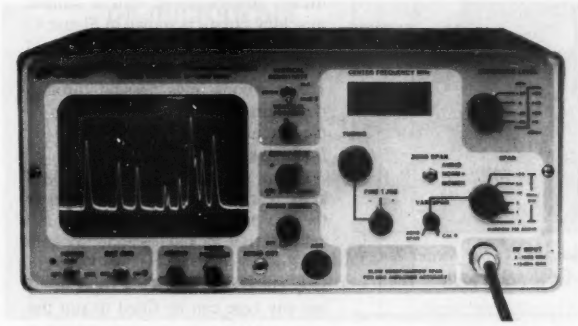
ELECTRON PROCESSING, INC
P.O. BOX 708
MEDFORD, NY 11763
(516) 764-9798

When Ordering please add $4 conterminous US, $7 AK, HI, PR, Canada Shipping/Handling. NYS address add sales tax.

SATISFACTION GUARANTEED! SEND FOR MORE DETAILS!

CIRCLE 291 ON READER SERVICE CARD

A New Spectrum Analyzer From AVCOM!



PSA-65A display of 270-770 MHz TVRO block downconverter showing SCPC, digital and video transponders.

The newest in the line of rugged **spectrum analyzers** from AVCOM offers amazing *performance* for only $2,675.

AVCOM'S new **PSA-65A** is the first low cost general purpose portable spectrum analyzer that's loaded with features. It's small, battery operated, has a wide frequency coverage and is accurate - a *must* for every technician's bench. Great for field use too.

The **PSA-65A** covers frequencies thru 1000 MHz in one sweep with a sensitivity greater than -90 dBm at narrow spans. The **PSA-65A** is ideally suited for 2-way radio, cellular, cable, LAN, surveillance, educational, production and R&D work. Options include frequency extenders to enable the **PSA-65A** to be used at SATCOM and higher frequencies, audio demod for monitoring, log periodic antennas, carrying case (AVSAC), and more.

Want to expand your technical horizons and become skilled at using Spectrum Analyzers—the most powerful and versatile RF instruments in existence today? AVCOM's PSA-65A is an ideal instrument to accomplish these goals. It's basic enough to begin with and sophisticated enough to keep pace with you as your technical requirements grow. Write, fax or call AVCOM for more information on this or on our other fine microwave and related products.

AVCOM BRINGING HIGH TECHNOLOGY DOWN TO EARTH

500 SOUTHLAKE BOULEVARD • RICHMOND, VIRGINIA 23236 • 804-794-2500
FAX: 804-794-8284, TLX: 701-545

QRP SWR Bridge

This simple project lets you monitor your antenna system's SWR.

by Tony Smith G4FAI

Low power (QRP) operating enjoys an enduring popularity in amateur radio. Much of the equipment is relatively simple to home-brew, and there isn't the need for many of the precautions required when operating at higher power levels.

Opinion on what constitutes low power varies between different countries, and between different operators in those countries. The G-QRP Club's definition of less than 5 Watts input, and the (American) QRP Amateur Radio Club International's maximum of 5 Watts output, are the power levels referred to in this article.

Transmitters need to "see" a specified load, usually 50 to 75 ohms, at their output. Whether the antenna in use is already matched to the required impedance, or whether the match is obtained through an antenna tuning unit (ATU), a standing wave ratio (SWR) bridge lets you monitor and adjust the effect of the load on the transmitter (Figure 1). (Many modern transmitters automatically reduce their output power if the antenna system presents a mismatch.) The bridge is thus a useful device to help obtain optimum performance at all times.

When a transmitter transfers power to a feeder line of the correct impedance, and the feeder terminates at an antenna also presenting the correct impedance, the antenna accepts and radiates all of the power coming to it. When the antenna has the wrong impedance, e.g. because the feeder is not correctly terminated, a portion of the power is reflected back down the feeder in the form of standing waves. The ratio between the forward power and the reflected power is the standing wave ratio, and the function of an SWR bridge is to indicate that ratio at the point where the bridge is located in the feeder line.

The Circuit

The design shown in Figure 2 is a simple unit for QRP operation on all authorized frequencies up to 30 MHz, based on a toroidal transformer T1. The secondary winding of T1 samples a small amount of RF power (both forward and reflected) which is divided by the bridge circuit and rectified by diodes D1 and D2. Forward and reflected readings are obtained simultaneously on the two meters M1 and M2, and the bridge is matched and balanced at the required load impedance by C1 and C2. See Figure 5 for an alternative, less expensive, single meter version. The bridge also measures forward power.

Although it should not be regarded as a laboratory instrument, the bridge is sufficiently accurate for all practical hamming purposes.

The project is housed in an easily constructed wood/hardboard case, partly to keep the cost down and partly to give the builder the satisfaction of creating a completely "home-brewed" unit. If you want to use a metal case, feed-through capacitors C4 and C5 are then unnecessary.

Construction

There are any number of ways to fabricate a case for the bridge. I built my case out of wood, using nails and glue to hold it together. I suggest drilling the holes for the nails, slightly undersize, to keep the wood from splitting. The front panel is secured by panel pins and glue, and the top and rear panels are secured by woodscrews to facilitate access and setting-up.

In the prototype, the nails and panel pins were punched below the surface level of the case and all gaps, holes, and irregularities made good with filler and rubbed down. The case, plus rear panel, was painted inside and out with matt black paint, and the top cover with black gloss. The front and sides were covered with Fablon™ after the meter holes had been cut out.

The holes for the meters were cut by marking the position of the meters on the front panel and drilling a series of small holes round the inside of the circle. The meter holes were then finished off with a half-round file. Exact details and measurements for meter and potentiometer mounting will depend on the particular meters obtained for the project.

You can use virtually any meter having a 100µA linear full-scale deflection (FSD), and these represent the main cost of the project. It's worth getting the best quality possible to ensure a long life in the meter mechanism. Those used in the prototype had a front face size of 60 x 45mm, a panel cut-out of 38mm diameter, and an accuracy of 2.5 percent.

The components are mounted on Veroboard as shown in Figure 3. Matched diodes are required and a simple matching circuit is shown in Figure 4. The circuit board is fitted on spacers inside a small aluminium box with 15mm woodscrews passing through the board, the spacers, the bottom of the box, and the earthing plate, into the floor of the case.

Mount the input and output sockets at the rear of the box, and drill holes in the rear panel of the case to allow access to the sockets. Phono sockets were used in the prototype, as these are frequently used for QRP operation, but any type can be fitted to suit the constructor's needs. Take care when fitting the sockets to ensure that they do not prevent the lid fitting properly on the box. Similarly, make sure the box will fit into the case, leaving room for the lip of the lid between the box and the rear panel.

Route the connections to the meters via feed-through capacitors, C4 and C5, which are intended to be soldered to chassis. As the box is aluminium this presents some difficulty. In the prototype, I drilled holes in the box (making sure the lid was not obstructed) which were marginally smaller than the diameter of the capacitors. I carefully enlarged the holes with the

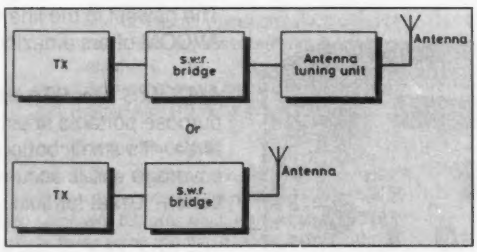


Figure 1. SWR bridge placement—keep the feeder length between the transmitter and bridge as short as possible.

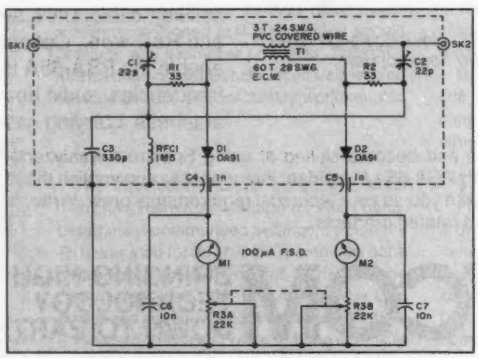


Figure 2. Circuit diagram of the QRP SWR bridge.

HF ANTENNAS FROM BUTTERNUT

The HF5B "Butterfly"™
A Compact 2 Element Beam
for 20-15-12-10 Meters
Operate As A Di-Pole on 17 Meters

- Unique design reduces size but **not** performance.
- No lossy traps; full element radiates on all bands.
- Turns with TV rotor
- 19 lbs.

Butternut Verticals

Butternut's HF verticals use highest-Q tuning circuits (not lossy traps!) to outperform all multiband designs of comparable size!

Model HF6V

- 80, 40, 30, 20 15 and 10 meters automatic bandswitching.
- Add-on kit for 17 and 12 meters available now.
- 26 ft. tall

Model HF2V

- Designed for the low-band DXer
- Automatic bandswitching on 80 and 40 meters
- Add-on units for 160 and 30 or 20 meters
- 32 feet tall - may be top loaded for additional bandwidth.

For more information see your dealer or write for a free brochure

BUTTERNUT ELECTRONICS CO.
405 East Market, Lockhart, TX 78644

Performance Above and Beyond

AR2002

Continuous Coverage
Professional Scanning
Monitor Receiver
25 – 550 MHz/800 – 1300 MHz

Specifications:

Receiving mode – Narrow band FM, Wide band FM & AM

Receiver circuit – Microprocessor controlled PLL Frequency synthesized superheterodyne type with high-level doubled balanced mixer

Receiver IF – 750MHz, 45.03MHz, 5.5 MHz (WFM) and 455kHz (NFM & AM)

Sensitivity – NFM – 0.35 uV (12dB SINAD)
WFM – 1.00 uV (12dB SINAD)
AM – 1.00 uV (10dB S/N)

Selectivity – NFM – ± 7.5kHz @ 6dB
± 25kHz @ 70dB
WFM – ± 50kHz @ 6dB
± 250kHz @ 60dB
AM – ± 5.0kHz @ 6dB
± 10kHz @ 70dB

Receive frequency coverage – 29 channels
Scan rate – 5 channels per second
Search rate – 5 steps per second
Search steps – 5, 10, 12.5, 15, 20, 25, 30, 50, 100, 125, 200 kHz
Search memory – 10 channels
Priority – 1 channel
Delay – 2 seconds
Memory backup – 10 years
Power requirements – 13.8 VDC @ 1.5 amps
Dimensions – 2.5" H x 6.5" W x 8.5" D
Weight – 3 lbs.

AR2002
Professional Monitor Receiver
$499.00
(California res. add $29.94 tax)
Visa and MasterCard orders welcome
Prices include shipping & handling
Except UPS. C.O.D. is $3.00 extra
Purchase orders accepted from Government agencies

22511 Aspan Street, Lake Forest, CA 92630-6321
Calif./Alaska (714) 581-4900
Facsimile (714) 768-4410 (not a phone)
TOLL FREE 1-800-523-6366

ACE communications

CIRCLE 279 ON READER SERVICE CARD

EVERY ISSUE of *73* on microfiche!

The entire run of *73* from October, 1960 through last year is available.

You can have access to the treasures of *73* without several hundred pounds of bulky back issues. Our 24x fiche have 98 pages each and will fit in a card file on your desk.

We offer a battery operated hand held viewer for $75, and a desk model for $200. Libraries have these readers.

The collection of over 600 microfiche, is available as an entire set, (no partial sets) for $180 plus $5 for shipping (USA). Annual updates available for $10.

Your full satisfaction is guaranteed or your money back. Visa/MC accepted.

BUCKMASTER PUBLISHING
"Whitehall"
Route 3, Route 56
Mineral, Virginia 23117

703-894-5777
800-282-5628

CIRCLE 365 ON READER SERVICE CARD

THEY'LL THINK THEY'RE JUST HAVING FUN

YOU'LL KNOW THEY'RE LEARNING

Carole Perry's (Dayton 1987 Ham of The Year) "Introduction To Amateur Radio" package allows children of all abilities to achieve success.

Ready-to-teach package contains: Teacher's Manual with 26 lesson plans, Code Practice Oscillator for Morse Code practice, Spacecode audiocassette which follows lesson plans. **$99.95**

- FREE Video Tape Showing Classroom Use

☐ Any motivated teacher can teach the program.
☐ Ham Radio program is used as a motivational tool to teach skills in other subject areas.
☐ 24 hour Hotline is available for help and questions.
☐ High motivational activities, homeworks, fund raisers, quizzes, & reproducibles included.

Media Mentors inc.
P.O. Box 131648
STATEN ISLAND
N.Y. 10313-0006
718-983-1416

CIRCLE 241 ON READER SERVICE CARD

tang of a small file until the capacitors could be secured with a press-tight fit and finally secured with a dab of "super-glue." This arrangement has proved quite satisfactory but purists might prefer to solder the capacitors to a small rectangle of tin plate and bolt the assembly to the side of the aluminium box. The wiring-up of the meters and the dual potentiometer should present no difficulty.

Setting-up

Once the unit is assembled, you must balance the bridge. Connect the transmitter to one of the rear sockets via a short length of coaxial cable having the same impedance as the TX output. A further length of the same cable connected to the other socket should be terminated by a non-inductive dummy load of the same impedance. You can make this up from one or more carbon resistors to obtain the resistance and wattage required.

Now apply a radio-frequency (RF) carrier at the highest used frequency. One meter should indicate a high, and the other a low, reading. Adjust the trimmer capacitor on the side of the bridge showing a low reading (reflected power) to obtain the lowest possible reading. Now, reverse the connections to the sockets and make the same adjustment with the trimmer for the second meter. Repeat this procedure once or twice until finally both meters, when indicating reflected power, read zero, and the bridge is then balanced. During this process, adjust the potentiometer so that whichever meter is indicating forward power is set at full-scale deflection.

Calibration—SWR

You can use either meter for forward or reflected power indication, depending on which socket is used for input or output. For SWR readings, both meters are used and that showing forward power needs only to indicate FSD. For reflected power, opinions differ on the need for detailed calibration. The most important marking is at a point exactly halfway across the scale, which represents an SWR of 3:1. Any SWR in excess of that may be detrimental to the transmitter. An SWR of 2:1 or less is acceptable, especially with low power.

Therefore, you need only a center marking to indicate maximum permissible SWR. The aim is to get the reading down to as near to zero as possible.

Calibration—Power

It's easy to get forward power readings since the circuit provides a reasonably uniform indication of RF power, irrespective of frequency, over its range of operation.

Calibration modes, unfortunately, require an external means of measuring RF power for comparison purposes. Those who have access to RF measurement can set the forward meter to FSD when the desired maximum RF power passes through it into a dummy load. Note the setting of the pointer on the control knob by making a mark on the front panel. With the control at this setting, feed successively lower RF powers through the unit and mark the meter scale accordingly.

Operation

The bridge should still be connected to the transmitter. Connect the output to an antenna system.

Apply power and check the meters. Adjust the tuner for minimum SWR (1:1 if possible). Take care that the forward meter reads FSD, but that it isn't pegging against the end-stop, as that can damage the meter.

If you are using an antenna system without a tuner, and the antenna is cut for the frequency for the input signal, you may want to check the bandwidth of your antenna. Do this by checking the SWR at different frequencies across a band. This will often show you how to alter the antenna dimensions for a different resonant frequency.

Leaving the bridge permanently in line lets you monitor the effect of the antenna system on the transmitter output. Bear in mind, however, that a low SWR indication does not necessarily mean an antenna is performing well. A dummy load, for example, presents a near 1:1 SWR through a matching feeder, and yet is virtually non-radiating. Too, it measures SWR only at the point in the feedline where the bridge is located—not at the antenna itself.

An SWR bridge is a valuable part of every radio operator's station. It is a useful tool when constructing antennas and exercises an essential control function when they are in use. Because of its simplicity it is an ideal project for home construction, especially for beginners, and with good quality components it will last for years. QRP operation itself offers enormous scope for home construction and experimentation, and a unit such as this should be an integral part of every QRP station.

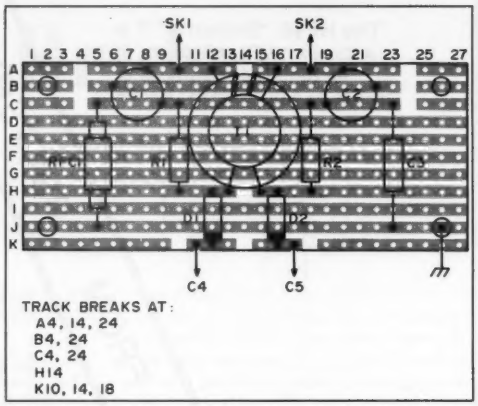


Figure 3. Component locations on the Veroboard. Drill the mounting holes very carefully to avoid damaging the board.

Warning

The unit as described is suitable only for low power operation. The circuit is capable of operation up to about 100 Watts.

Taken from *Practical Wireless*, October 1983.

COMPONENTS

Resistors		
Carbon film ¼W 5%		
33Ω	2	R1,2 (Matched, see text)
Potentiometers		
Dual-ganged		
22kΩ	1	R3
Capacitors		
Ceramic		
10µF	2	C6,7
Feed-through		
1µF	2	C4,5
Polystyrene		
330pF	1	C3
Miniature trimmer		
2-22pF	2	C1,2
Semiconductors		
Diode		
OA91	2	D1,2 (Matched, see text)
Miscellaneous		

Meter 100µA FSD(2); RF Choke 1.5mH (1); Toroidal core T68-2 (1); Veroboard 0.1 inch matrix 24 holes x 10 tracks; Metal box 73 x 51 x25mm; Phono sockets (2); Pointer knob; Enamelled copper wire 28 s.w.g. (1.3m); Insulated wire 24 s.w.g. (100mm).

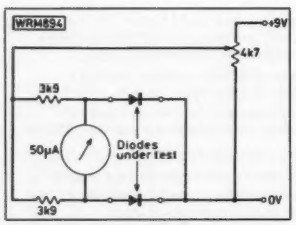


Figure 4. Simple diode matching circuit. Match the two resistors with an ohmmeter. As the voltage is increased by rotating the potentiometer, the meter should not deflect more than 1 µA from its no-current setting. It may be necessary to test several diodes to obtain a matched pair.

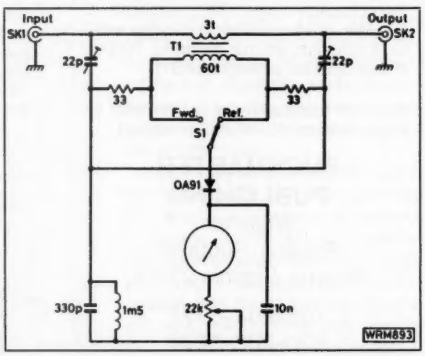


Figure 5. Single meter version of the SWR bridge.

Atlanta HamFestival
July 8th & 9th

- Free Parking within 25 yards!
- Hotel and Restaurant same building
- Tailgate Sales
- Air Conditioned Flea Market and Exhibits
- Country Style BBQ
- Parking for RV's
- 20+ Forums • DX Verification • Testing
- Prizes! Prizes!! Prizes!!!
- ICOM, KENWOOD, YAESU, MFJ ...More!

New Location!!!

24 hour information --- (404) 739-8716

or
write

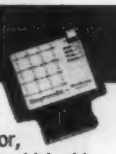
Atlanta HamFestival
Post Office Box 77171
Atlanta, Georgia 30357

NEW PRODUCTS!

QRP POWER

STRAD-PACK rechargeable NiCad 12v battery pack offers 3.5 ampere-hours. Powers your portable radio or any other 12v device! Perfect for field excursions!
STRAD-PACK: $79.90
Charger: $59.90

DOCTOR YOUR COMMODORE!



Micro Doctor C-64 diagnoses Commodore 64 computer problems without the aid of monitor, drive or keyboard. Display tells you which chip needs attention. A Commodore owner's delight!
Micro Doctor C-64: $150.00

ORDER FACTORY DIRECT!
303/789-0424

Visa and MasterCard accepted. Prices do not include shipping or applicable sales tax.
DEALERSHIPS AVAILABLE

MICRO R&D INCORPORATED
3107 West Hampden
Sheridan, CO 80110

G5RV All-Band QuicKits™

Fast & Easy to Build
- Failsafe visual instructions
- No measuring or cutting
- Everything included
- Finish antenna in minutes

Quality Components
- Preseldered Coax Fittings
- Kinkproof QuietFlex wire
- Fully insulated, wx sealed, no-corrode, low noise design

Fastest Antennas in the West
AntennasWest
(801) 373-8425

- Double Size G5RV 204 ft 160-10 Dipole $59.95
- Full Size G5RV 102 ft 80-10 Dipole $34.95
- Half Size G5RV 51 ft 40-10 Dipole $24.95
- Quarter Size G5RV 26 ft 20-10 Dipole $19.95
- Marconi Adapter kit converts any dipole to Marconi $ 4.95
- 200' Dacron 250# line $11.95
Add $5 Post & Handling Info $1

Box 50062-S, Provo, UT 84605

CIRCLE 107 ON READER SERVICE CARD

HI-PERFORMANCE DIPOLES

Antennas that work! Custom assembled to your center freq. ea. band - advise ht. of center and each end - hang as inverted "V" - horizontal, vert dipole, sloping dipole - commercial quality - stainless hardware - legal power - no-trap, high-efficiency design. Personal check, MO or C.O.D. ($3)

MPD-5*	80-40-20-15-10M max-performance dipole 67' long	$106ppd
MPD-2	80-40M max-performance dipole, 85' long 262	85'-$86 ppd
HPD-3*	160-80-40M hi-performance dipole 113' long	$79 ppd
SSD-5*	160-80-40-20-15-10M space saver dipole 71' long	$126 ppd
SSD-5*	80-40-20-15-10M space-saver dipole-specify L. 42'-$106	82'-$108 ppd
SSD-4*	80-40-20-15M space-saver dipole-specify L. 45'-$93	80'-$ 96 ppd

*9-bands with wide-matching-range tuner.

SASE for catalogue of 30 dipoles, slopers, and space-saving, unique antennas

312-394-3414 BOX 393 WYMAN ANTENNAS MT. PROSPECT, IL 60056

CIRCLE 38 ON READER SERVICE CARD

N6KW QSL Cards

The finest QSL Cards at reasonable prices. Basic cards, map cards, cartoon cards, photo cards and more. Your idea converted to ink, or use standard designs. 525 ink colors, any type of card stock. Photos in b/w or beautiful color. Have a card that fits your style. Call or write for free samples and details. Postage appreciated.

Chuck Miller N6KW
KW Litho - Dept. 73
P.O. Box 17390
Ft. Worth, TX 76102
(817) 332-3658

CIE Cleveland Institute of Electronics

Accredited Member National Home Study Council

CIE is the world's largest independent study electronics school. We offer ten courses covering basic electronics to advanced digital and microprocessor technology. An Associate in Applied Science in Electronics Engineering Technology is also offered.

Study at home — no classes. Programs accredited and eligible for VA benefits.

CIE Cleveland Institute of Electronics
1776 East 17th St., Cleveland, Ohio 44114

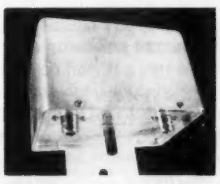
YES! I want to get started. Send me my CIE school catalog including details about the Associate Degree program.

Print Name _____
Address _____ Apt. _____
City _____ State _____ Zip _____
Age _____ Area Code/Phone No. _____
Check box for G.I. Bulletin on Educational Benefits
☐ Veteran ☐ Active Duty MAIL TODAY!

AAR102

CIRCLE 157 ON READER SERVICE CARD

HIGH POWER RF SWITCHED PREAMPS



Model 146 160W 2 Meters 19db Gain .75db Nf
Model 146OS 160W 2 Meters 19db Gain .75db Nf
Model 440 70cm 100W 16db Gain .75db Nf

All preamps have helical filters to prevent out of band intermodulation in the receiver. Model 146 covers the entire 2 meter band. Model 146OS is of very narrow bandwidth and would be suitable for SSB. Packet, or Satellite. Model 440 is factory tunable from 430–440 MHz or 440–450 MHz per customer request. All models are powered with 13 to 20 VDC and are mounted at the antenna.

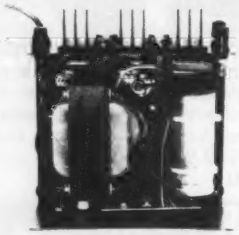
Model 146 $179
Model 146OS $179
Model 440 $189

AMPIRE, INC.
10240 NATHAN LANE
MAPLE GROVE, MINN
55369
612-425-7709

ASTRON CORPORATION
9 Autry
Irvine, CA 92718
(714) 458-7277

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •



INSIDE VIEW — RS-12A

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models **except RS-3A, RS-4A, RS-5A.**
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

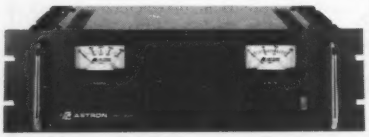
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES



MODEL RM-35M

19″ × 5¼ RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

continued from p. 25

Winding a transformer can be tricky when you're trying to get the right wire soldered to the correct circuit board pad. Refer to T4 on Figure 6. Note the dots. These are "phasing" dots. They indicate which wires are on which end of the winding. Numbers 1 and 2 are the ends of one wire, 3 and 4 are the ends of another, and 5 and 6 are the ends of another. Numbers 1, 3, and 5 begin the coil and 2, 4, and 6 are at the other end.

Notice, however that 2, 3, and 6 are connected together and go in one hole in the board. They are all at ground. Thus, there are only 4 connections to the circuit board.

You will probably need to use an ohmmeter to check which wires are continuous after winding the toroid. A simpler way, however is to use different colors of wire. You can use 26 or 30 gauge wire inplace of No. 28 wire. You may mix sizes if you have different colored wire of different sizes. This saves a great deal of time. The wire sizes should not be too dissimilar, though.

When you are working with the wire wound on a toroid, you will notice that it is enameled for insulation. You will have to either scrape the enamel off of the wire tips while you're soldering it to the board, or melt it off with the soldering iron. Melting it off works, but creates a mess. It helps to burn the enamel with a match before scraping.

When winding toroids, space the turns evenly. Do not bunch them.

•A shield around the VFO box can be tack-soldered to the board easily. Just a few tacks to each side will do nicely. You may have to remove it a time or two, so do not solder it down permanently until the very end.

•This board is intended to fit nicely into a project box that is available at Radio Shack. It is approximately 6" x 5½". You can mount a speaker against the side wall of the cabinet top, where the vents are located, and is glue it in place. First, glue a small rectangle of cloth to the box, and then glue the speaker to the box. Make sure the material covers only the vents. The speaker must overlap the material to adhere to the box.

•Some components may have to be formed, trimmed, or clipped to properly fit the board. This is especially true of trimmer capacitors which come in many, many different sizes and shapes. Do not be afraid to do some "engineering" in this regard. A ham's ability to do this is what makes this hobby what it is.

•With a direct conversion receiver, it is extremely important to make all connections very solid, especially ground connections. I recommend a double-sided PC board. If you keep grounding foremost in your mind, you will do fine. If a part is to be grounded, you may solder it not only to the pad on the underside of the board but also to the upper side of the board. This is why the copper is not drilled out around the upper part of the board for grounded parts. Use plenty of solder when you attach these parts to each side of the board.

•Make coax and power ground connections to the upper part of the board. Simply solder the shield to the board ground plane on the upper part of the board. The same holds true for the power connection. Insert the positive lead into the proper hole and and solder it to the correct pad on the underside of the board. Then, just solder the negative lead to the ground plane.

•As with any DC receiver, you will hear the signal you are tuned to on both sidebands. The superheterodyne receiver by its very nature only "hears" one sideband. Consequently, you will need to tune to the proper sideband when you want to QSO a station so that you are not way off frequency. Tune on the "lower side" of the zero beat. This will insure that you are in correct position.

•Note the coax jumper from the VFO to the mixer transformer T5. RG-174 is handy for this purpose.

Tune up, Operation, and Troubleshooting

If you have followed the steps above, you have already gotten this rig in an operable state. Simply align the VFO, tweak the driver trimmer C18, tweak the RF amp trimmer, C23, set the RIT control R9 at half scale, and hang on to your hat!

I have made every mistake possible in building this rig. I will gladly respond to written requests for help. I have tried to guide you around some of them so that if you have hesitated to start a project before, you will give it a try this time.

Finding Parts

The parts list, Table 1, gives a Radio Shack part number for most parts needed for this project. The more exotic ones, such as variable capacitors, trimmer C4, toroids, semiconductors, dials, and printed circuit board materials can be found in a number of mail order catalogs. One supplier in particular is dedicated to carrying parts for homebrewers.

Do not be afraid to scrounge around flea markets, surplus electronics parts houses, or your own junk box for parts. My motto is: "When in doubt, try it!" Most metropolitan cities have surplus houses that sell new (or at least unused) parts at dirt cheap prices. You just have to root around for a while to find your treasures. I once found a whole box full of vernier dials that I bought for two dollars apiece. New, they are ten dollars. Persevere, and save on parts!

Good luck and happy home-brewing!

BIBLIOGRAPHY

Cornelio Nouel, "40 Meters in a Nutshell," *73 Amateur Radio*, March 1987.

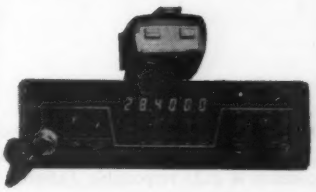
DeMaw, *QRP Notebook*, ARRL, 1986.

Hayward and DeMaw, *Solid State Design for the Radio Amateur*, ARRL, 1977.

Carr, "Ferreting out the Problem," *Ham Radio*, June 1988. An excellent instructional on understanding toroids and how to wind them.

10 METER DX IS HOT!

AND YOU CAN WORK IT WITH THE NEW RANGER AR 3500



- Compact Mobile Transceiver
- Microprocessor Controlled Design
- All Mode SSB/CW/AM/FM
- Effective Noise Blanker
- Five Selectable Memory Channels
- Programmable Band Scan
- Large Six Digit Frequency Readout
- Split Frequency Repeater Operation
- Dynamic Mic & Power Cable
- Mic with Frequency Scanning Buttons (optional)
- Limited 1 Year Factory Warranty by Clear Channel Inc. Issaquah, WA

SPECIFICATIONS

Frequency Range: 28.0000-29.9999 MHz in 100 Hz steps
Sens.: SSB/CW .15 µV, FM/AM .3 µV
Power: SSB 25W PEP, 30W, CW, 8W FM/AM
Input: 12.5 V, 6A DC
Dimensions: 2.4"×7.7"×11" Wt: 3 Lbs.

We made a special purchase of these fine transceivers and thus able to offer them at a very attractive price

Our Regular Price $369.95

Special! $299.95

AVAILABLE OPTIONS

100 Watt model	(call for details)
Mic w/ Freq. Scan. Buttons*	$30.00
SP-1 Speech Processor*	30.00
CW Auto break-in & pwr control*	30.00
Service Manual AR3300/AR3500	20.00
3 Element Beam, 26-30 MHz	89.95
Penetrator Mobile Ant.	47.95
Antron A-99 Vertical Base Ant.	49.95
RS7A Pwr Supply for 30W Ranger	52.95
RS35A Pwr Supply for 100W Ranger	142.95

*sale price with radio purchase only

Offer limited to available stock
Send a SASE for detailed brochure

Quantity Pricing Available Foreign Orders Accepted
Orders received by 1 PM PST shipped UPS same day.
COD / VISA / MC Next day UPS delivery available
No extra charge for C.O.D. or VISA Mastercard Orders
ORDER DESK ONLY — NO TECHNICAL
(800) 854-1927
ORDER LINE and/or TECH HELP
(619) 744-0700
FAX (619) 744-1943

RF PARTS COMPANY
1320 Grand San Marcos
California 92069

Six Meter QRP Station

Who says we don't use tubes anymore?

by Tima Popovich ex-YU1FR

The unit described in this article proved the theory that it is possible to establish contacts at quite respectable distances with very low power.

Designed primarily for mobile use, the station runs from a 6 volt battery. For 12 volt operation, the heaters will have to be rewired and changes made in the power supply. An AC supply is included, making it a station for all-around use.

Before going into the details of construction, here is a brief description of the various parts.

The Transmitter

The oscillator is a Jones circuit which, compared with other circuits, furnishes a high range of potent harmonics. The crystal is of the highest possible frequency so that enough drive is available for the final. The final uses push-pull 6AK5s which, at low input, give 1 to 1½ Watts of output. I used 6AK5s because of their low heater drain (175 mA) and good high frequency efficiency.

The Receiver

The receiver is a superhet with a regenerative detector. This gives the best compromise between battery drain and performance. When possible, I used 6AK5s to reduce battery drain. The line-up uses a 6AK5 oscillator, 12AT7 cascode RF amplifier, 6AK4 oscillator, 12AT7 cascode RF amplifier, 6AK5 IF amplifier, 6AK5 regenerative detector, and 6AK5 audio output. The output is enough to drive a pair of headphones or a small, sensitive speaker. If you want more output, you could use a 6AQ5 at the cost of higher battery drain.

The Modulator

The modulator is extremely simple, consisting of one tube. A carbon microphone provides enough output to drive a 6AQ5, plate and screen modulating the final amplifier. The microphone is coupled to the 6AQ5 through a carbon microphone transformer. The quality is good and there is plenty of modulation.

Power Supplies

There are two independent power supplies in the transceiver. The mobile supply is a conventional vibrator supply delivering about 200 volts at 80 mA. The AC supply is also conventional and delivers the same voltages in addition to rectified and filtered low voltage DC for the operation of the relay and microphone.

Warm Up The Iron!

Now that I've given you a description of the transceiver, the next step is to drag out the soldering iron and begin the construction. The schematic for the transmitter and modulator is shown in Figure 1. The Jones oscillator is of the cathode feedback variety. The feedback is caused by the RF voltage drop across the RFC in the cathode. A small RF choke in parallel with a 3–30 pF trimmer is used. The trimmer adjusts the amount of feedback to compensate for the lack of activity of some crystals. To adjust this, use an inactive crystal and set the trimmer so that the oscillator cuts in smoothly and reliably. This setting will be good for all other crystals.

The choke in the cathode consists of #28 wire close-wound 1" on a ⅜" slug-tuned form. The crystal can either be 12.5 or 16.5 MHz. The screen supply of the oscillator has a form of voltage regulation caused by feeding voltage through a 10 k resistor with an NE2 or similar neon connected from the screen to ground. The plate of the oscillator is connected to a transformer consisting of L1 and L2. The final amplifier is a conventional push-pull circuit with L2 as the grid coil and L3 as the tank circuit.

Modulator layout is not critical, the only

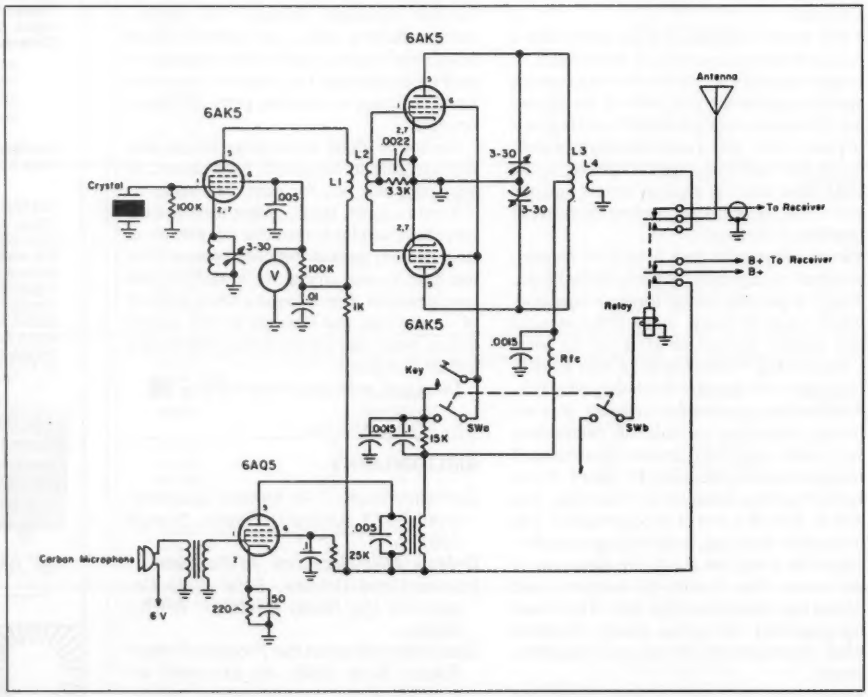


Figure 1. Schematic for the QRP transmitter and modulator.

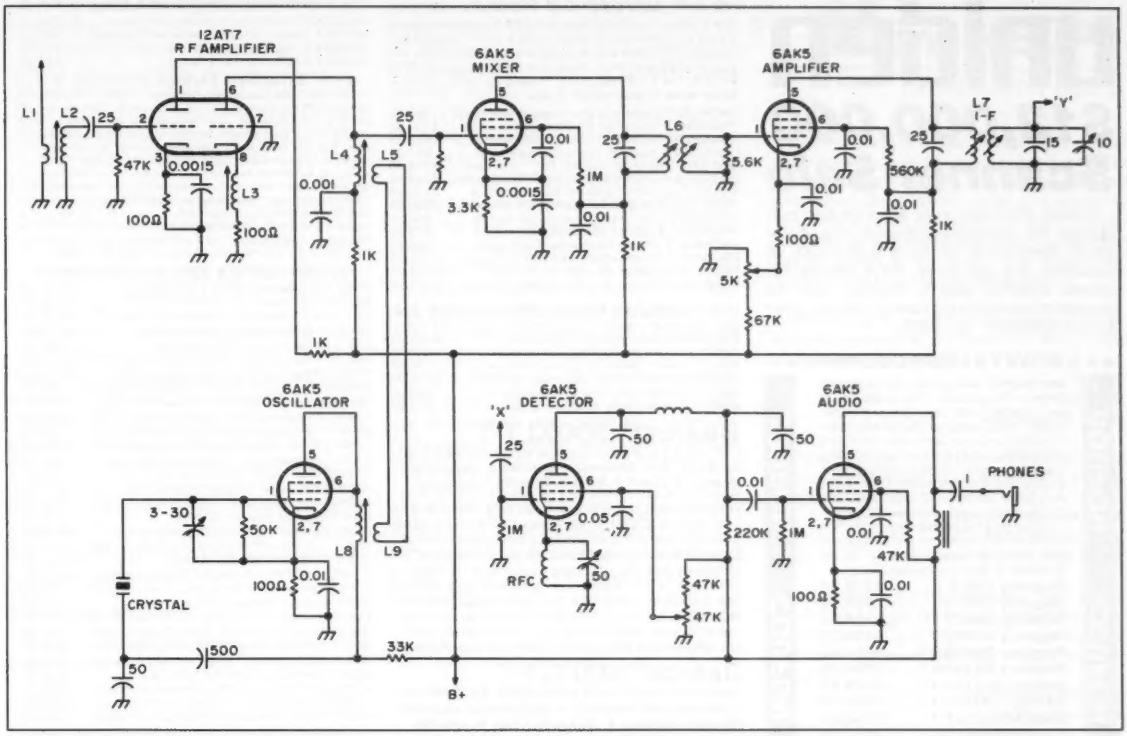


Figure 2. Receiver schematic. Add 100 pF capacitor from pin 1 to pin 8 of the 12AT7.

precaution being that you keep the plate leads away from the grid leads. A 0.005 µF condenser is placed across the primary of the modulation transformer to prevent any undesirable feedback. I wound the modulation transformer myself because there weren't any around at the time. A Triad M4Z or similar transformer is best.

Pay attention to the receiver layout. The RF amplifier is a cascode using a 12AT7 or 6BQ7. Although the cascode was not neutralized, there were no feedback or oscillations. The stage is bandpassed with L2 tuned to the high end. A 10 MHz crystal is used on its third overtone, giving an IF of 20 MHz. It is then coupled through L6 to the regenerative detec-

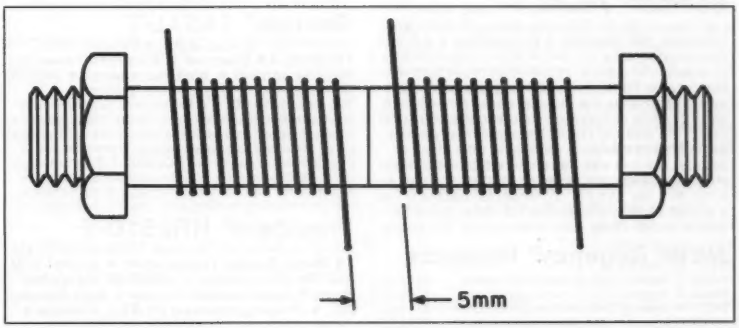


Figure 3. Receiver IF coil.

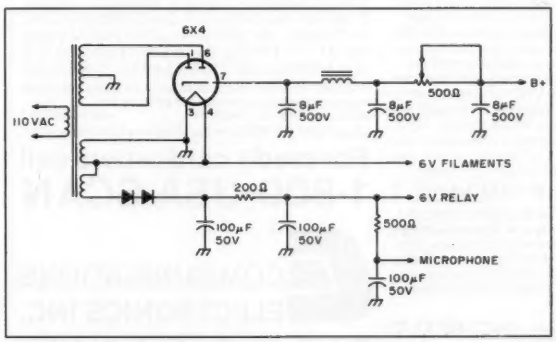


Figure 4. AC power supply.

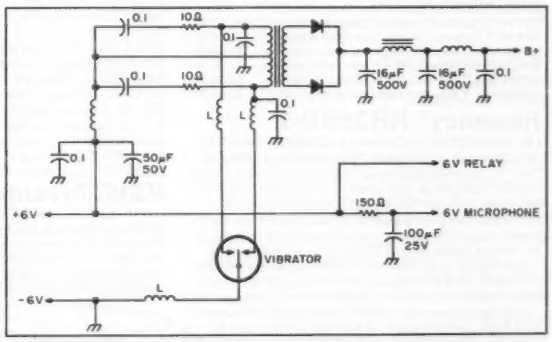


Figure 5. Six volt power supply.

uniden®

$12,000,000 Scanner Sale

Uniden Corporation of America has purchased the consumer products line of Regency Electronics Inc. for $12,000,000. To celebrate this purchase, we're having our largest scanner sale in history! Use the coupon in this ad for big savings. Hurry...offer ends September 30, 1989.

★★★ MONEY SAVING COUPON ★★★

COUPON COUPON

Get special savings on the scanners listed in this coupon. This coupon must be included with your prepaid order. Credit cards, personal checks and quantity discounts are excluded from this offer. Offer valid only on prepaid orders mailed directly to Communications Electronics Inc., P.O. Box 1045 – Dept. UNI8, Ann Arbor, Michigan 48106-1045 U.S.A. Coupon expires September 30, 1989. Coupon may not be used in conjunction with any other offer from CEI. Coupon may be photocopied. Add $11.00 for shipping in the continental U.S.A.

Regency TS2-T $259.95
Regency INF5-T.....$79.95
Regency R2060-T1 .....$114.95
Regency UC102-T $109.95
Regency RH606B-T.....$419.95
Regency RH256B-T.....$294.95
Bearcat 200XLT-T $249.95
Bearcat 100XLT-T $184.95
Bearcat 800XLT-T $249.95
Uniden HR2510-T $229.95
Uniden PRO500D-T1.....$32.95

★★★★ VALUABLE COUPON ★★★★

Bearcat® 760XLT-T

List price $499.95/CE price $244.95/SPECIAL
12-Band, 100 Channel • Crystalless • AC/DC
Frequency range: 29-54,118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-T** is a similar version without the 800 MHz. band for only $194.95. Order your scanner from CEI today.

NEW! Regency® Products

R4030-T *Regency* 200 ch. handheld scanner $254.95
R4020-T *Regency* 100 ch. handheld scanner $189.95
R4010-T *Regency* 10 channel handheld scanner...$114.95
R1600-T *Regency* 100 channel mobile scanner ...$244.95
P200-T *Regency* 40 channel CB Mobile $38.95
P210-T *Regency* 40 channel CB Mobile $56.95
P220-T *Regency* 40 channel CB Mobile $79.95
P300-T *Regency* 40 channel SSB CB Mobile.....$137.95
P400-T *Regency* 40 channel SSB CB Base.....$174.95
PR100-T *Regency* visor mount radar detector $54.95
PR110-T *Regency* "Passport" size radar detector ...$114.95
PR120-T *Regency* "micro" size radar detector....$144.95
MP5100XL-T *Regency* 40 Ch. marine transceiver...$139.95
MP5510XL-T *Regency* 60 Ch. marine transceiver...$159.95
MP6000XL-T *Regency* 60 Ch. marine transceiver...$209.95
MP2000XL-T *Regency* handheld marine trans.....$189.95

Regency® RH256B-T

List price $799.95/CE price $299.95/SPECIAL
16 Channel • 25 Watt Transceiver • Priority
The *Regency* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-T** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-T** is also available and covers 450-482 MHz. but the cost is $454.95.

★★★ Uniden CB Radios ★★★

The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

PRO310E-T *Uniden* 40 Ch. Portable/Mobile CB...$83.95
PRO330E-T *Uniden* 40 Ch. Remote mount CB...$104.95
PRO500D-T *Uniden* 40 Channel CB Mobile $38.95
KARATE-T *Uniden* 40 channel rescue radio $53.95
GRANT-T *Uniden* 40 channel SSB CB mobile....$166.95
MADISON-T *Uniden* 40 channel SSB CB base...$244.95
PC122-T *Uniden* 40 channel SSB CB mobile.....$119.95
PRO510XL-T *Uniden* 40 channel CB Mobile.....$38.95
PRO520XL-T *Uniden* 40 channel CB Mobile.....$56.95
PRO530XL-T *Uniden* 40 channel CB Mobile.....$79.95
PRO540E-T *Uniden* 40 channel CB Mobile.....$97.95
PRO640E-T *Uniden* 40 channel SSB CB Mobile ...$137.95
PRO710E-T *Uniden* 40 channel CB Base $119.95
PRO810E-T *Uniden* 40 channel SSB CB Base ...$174.95

★★★ Uniden Radar Detectors ★★★

Buy the finest *Uniden* radar detectors from CEI today.
TALKER-T *Uniden* talking radar detector.....$184.95
RD7-T *Uniden* visor mount radar detector $99.95
RD9-T *Uniden* "Passport" size radar detector $114.95
RD9XL-T *Uniden* "micro" size radar detector.....$144.95
RD25-T *Uniden* visor mount radar detector.....$54.95
RD500-T Uniden visor mount radar detector.....$74.95

Bearcat® 200XLT-T

List price $509.95/CE price $254.95/SPECIAL
12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout
Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T

List price $549.95/CE price $259.95/SPECIAL
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4⅛" x 12⅛." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/CE price $94.95/SPECIAL
10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC
Bands: 29-54, 136-174, 406-512 MHz.
The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/CE price $239.95/SPECIAL
10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • Preprogrammed 10 KHz. Channels
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

NEW! President® HR2600-T

List price $599.95/CE price $299.95/SPECIAL
10 Meter Mobile Transceiver • New Features
Delivery for this new product is scheduled for June, 1989.
The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.

BC760XLT
800 MHz. mobile scanner SPECIAL!

★★★ Facsimile Machines & Phones ★★★

FAX3300-T *Pactel* Fax machine with phone $1,099.95
XE750-T *Uniden* Cordless Phone with speaker $99.95
XE550-T *Uniden* Cordless Phone.....$79.95
XE300-T *Uniden* Cordless Phone.....$69.95

★★★ Extended Service Contract ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

OTHER RADIOS AND ACCESSORIES

BC55XLT-T *Bearcat* 10 channel scanner $114.95
BC70XLT-T *Bearcat* 20 channel scanner.....$159.95
BC175XLT-T *Bearcat* 16 channel scanner $156.95
R2060-T *Regency* 60 channel scanner.....$149.95
TS2-T *Regency* 75 channel scanner.....$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver...$114.95
BPS5-T *Regency* 16 amp reg. power supply.....$179.95
BP205-T Ni-Cad batt. pack for BC200/BC100XLT...$49.95
B8-T 1.2 V AA Ni-Cad batteries (set of eight).....$17.95
FBE-T Frequency Directory for Eastern U.S.A.....$14.95
FBW-T Frequency Directory for Western U.S.A.....$14.95
RFD1-T Great Lakes Frequency Directory.....$14.95
RFD2-T New England Frequency Directory.....$14.95
RFD3-T Mid Atlantic Frequency Directory $14.95
RFD4-T Southeast Frequency Directory $14.95
RFD5-T N.W & Northern Plains Frequency Dir. $14.95
ASD-T Airplane Scanner Directory.....$14.95
SRF-T Survival Radio Frequency Directory $14.95
TSG-T "Top Secret" Registry of U.S. Govt. Freq. ...$14.95
TTC-T Tune in on telephone calls.....$14.95
CBH-T Big CB Handbook/AM/FM/Freeband.....$14.95
TIC-T Techniques for Intercepting Communications ...$14.95
RRF-T Railroad frequency directory $14.95
EEC-T Embassy & Espionage Communications....$14.95
CIE-T Covert Intelligence, Elect. Eavesdropping ...$14.95
MFF-T Midwest Federal Frequency directory.....$14.95
A60-T Magnet mount mobile scanner antenna.....$35.95
A70-T Base station scanner antenna $35.95
A1300-T 25 MHz.–1.3 GHz Discone antenna.....$109.95
USAMM-T Mag mount VHF ant. w/ 12' cable $39.95
USAK-T ¾" hole mount VHF ant. w/ 17' cable $35.95
Add $4.00 shipping for all accessories ordered at the same time. Add $11.00 shipping per radio and $4.00 per antenna.

BUY WITH CONFIDENCE

To ***get the fastest delivery from CEI*** of any scanner, send or phone your order directly to our Scanner Distribution Center.™ Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. All sales on accessories are final. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on backorder automatically unless CEI is instructed differently. A $5.00 additional handling fee will be charged for all orders with a merchandise total under $50.00. Shipments are F.O.B. CEI warehouse in Ann Arbor, Michigan. No COD's. Most items listed have a manufacturer's warranty. Free copies of warranties on these products are available by writing to CEI. Non-certified checks require bank clearance. Not responsible for typographical errors.

Mail orders to: Communications Electronics,™ Box 1045, Ann Arbor, Michigan 48106 U.S.A. Add $11.00 per scanner for U.P.S. *ground* shipping and handling in the continental U.S.A. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping charges are three times continental U.S. rates. If you have a Discover, Visa, American Express or Master Card, you may call and place a credit card order. 5% surcharge for billing to American Express. Order toll-free in the U.S. Dial 800-USA-SCAN. In Canada, dial 800-221-3475. FAX anytime, dial 313-971-6000. If you are outside the U.S. or in Michigan dial 313-973-8888. Order today.

Scanner Distribution Center™ and CEI logos are trademarks of Communications Electronics Inc.
Sale dates 3/8/89 — 9/30/89 AD #030889-T
Copyright © 1989 Communications Electronics Inc.

For credit card orders call 1-800-USA-SCAN

COMMUNICATIONS ELECTRONICS INC.™

Consumer Products Division

P.O. Box 1045 □ Ann Arbor, Michigan 48106-1045 U.S.A.
For orders call 313-973-8888 or FAX 313-971-6000

CIRCLE 121 ON READER SERVICE CARD

tor. An RF gain control prevents overload of the detector.

The detected signal passes through a filter network which removes RF from the audio. The audio output stage has a choke in the plate circuit which should be as large as possible when used with phones. You could use an audio output transformer with a speaker, instead.

The IF transformers are really no problem to build. The coils are wound on two forms 8 mm (approximately ⅜") in diameter which are joined together as shown in Figure 3. You can substitute standard 21 MHz television IF transformers.

The power supplies are standard and no special precaution has to be taken. The two filament windings are connected in series and rectified to provide low voltage DC for the relay and microphone. There is a resistor for adjusting the output voltage of the transmitter. This should be set to about 200 volts in order to prevent damaging the 6AK5s. The filament leads are shielded to prevent pickup of vibrator buzz when used in mobile operation. The mechanical layout for the chassis are shown in Figures 6 and 7.

Testing and Alignment

Check all voltages. When checking the plate voltage of the 6AK5 detector tube, you should hear a click indicating that the audio works. The most critical part is the IF alignment. Using a signal generator or a grid dip meter, couple a 21 MHz signal into the grid of the 6AK5 mixer and tune the 2 IF transformers for maximum signal. If the signal is too strong, it will whistle strongly, then you may have to slightly drop the screen voltage of the detector. The oscillator is then tuned to the correct frequency. L2, 3, and 4 are tuned as described earlier and adjusted for maximum sensitivity.

Transmitter tune-up is simple. Tune the plate circuit of the oscillator to 50 MHz and adjust the trimmer in the cathode and plate coil for maximum output. Then insert a less active crystal and adjust the cathode trimmer so that it will oscillate without using excessive feedback, which can damage the crystals and cause poor stability. Next adjust the final coils for maximum output.

The unit is now complete. After using it a while, you will be amazed at the performance of such a simple rig. If you take care, you will have a station you can use at home, in the car, or anywhere you want to take it. 73

Taken from November, 1964 73 Magazine.

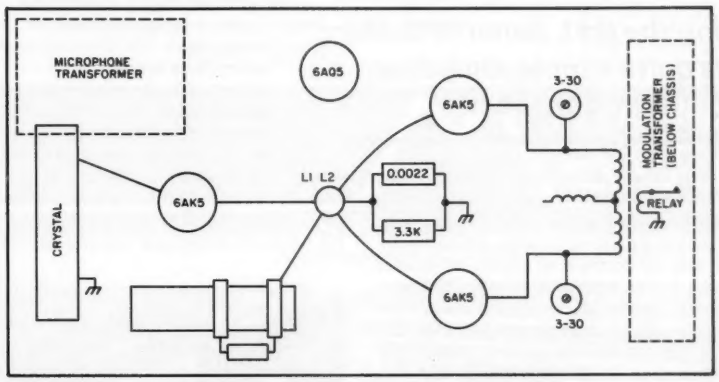


Figure 6. Transmitter layout.

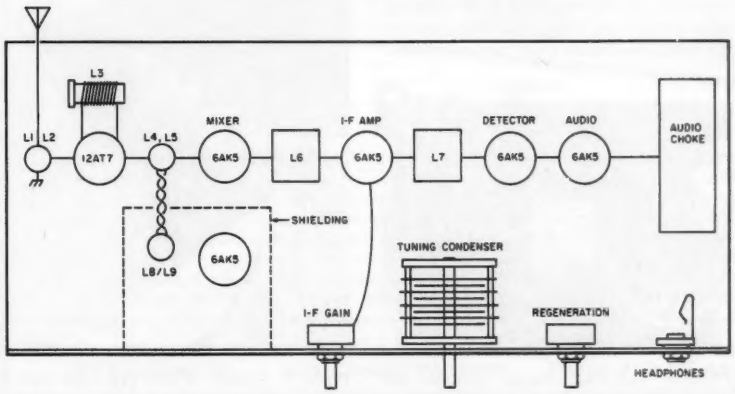


Figure 7. Receiver layout.

Number 16 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier, and to ensure that your listing is correct, please type or print your request clearly, double-spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters, and print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

I am looking for sources of ham-related and IBM emulation software for the Hewlett Packard HP150 (touchscreen) computer.

Paul Elliott N3GPU
Box 1480
Columbia MD 21044

I need 10 C cell NiCd batteries with solder tabs. Surplus or used would be OK if they are in working condition. Thank you.

Robert F. Cann W4GBB
2708 Old Point Drive
Richmond VA 23233

I'm looking for a Programmer's Tool Kit for Hewlett-Packard HP-110 Portable (or Portable Plus), such as HP calls: "HP 45419C." Also any software for this vintage laptop, preferably amateur radio applications.

Chuck Waite WA3JWF
89 Shagbark Drive
Shavertown PA 18708

Wanted: Manual and schematic for a scanner for the Kenwood TR-7400A manufactured by Amateur Wholesale Electronics. This is the unit with 16 push-buttons on the front that mount on the underside of the radio. I have one that needs rebuilding. Will pay for copying and postage. Please help me get this puppy running again!

Paul Braun WD9GCO
2102 Yorktowne Drive
Valparaiso IN 46383

Need: Schematic and/or service manual for National NCX3. Will pay copying and mailing costs.

R.G. Ballou K3MQH
3601 Tower Drive
Dover PA 17315

I am looking for hams who manned the US end of the MARS net and fellow GIs who manned the Nam end of the net during 1965–73. I'm writing an article for *The Veteran* that salutes the hams who helped us keep in touch with our families via MARS. Write me at the address below, or call (201) 548–8096 (home), (201) 893–4254 (campus office), or (201) 548–2266 (private office).

Paul A. Scipione, Ph.D.
5 Burr Drive
Metuchen NJ 08840

We are pleased to announce the formation of a licensed ham radio group made up of members of Alcoholics Anonymous. The purpose of the group is to enhance fellowship among the members who may have difficulty attending regular AA meetings. The plan is to schedule contacts via amateur radio at prearranged times and frequencies. Contact:

HAAM RADIO 4+5+9
ARS N8KDW
4121 S. Fulton Place
Royal Oak MI 48072
(313) 549–5275

73 Review

by Michael Bryce WB8VGE

Antennas West Solar Power Supply

Good for even more than QRP!

Antennas West
Box 50062
Provo, UT 84604
801-373-8425
Price Class: $290 plus $10 shipping

In the past, generating power from the sun was a hit or miss proposition. Most of the early solar electric pioneers used surplus panels, with somewhat less than outstanding results. The technology and economics of converting energy from the sun directly into electricity have improved rapidly.

Antennas West's solar power supply is an excellent first step in converting to solar power. The heart of the Antennas West solar module is the Sovonics P-201 panel. Sovonics is a forerunner in amorphous silicon, or "thin film" cells.

Innovative Development

Until recently, most solar cells were made of crystalline silicon, which has the regular lattice structure of a typical crystal—much like a crystal of salt or sugar. The amorphous, or irregular, structure considerably increases the possibility that light will be absorbed, because the photons interact more with the amorphous structure. This means that an amorphous cell can be made with less material than is needed with the more common crystalline silicon. Amorphous cells can be made only one micron thick, while crystalline silicon cells are typically 300 microns thick. Amorphous silicon cells are applied to a substrate of stainless steel (as Sovonics does). Then the panel is encapsulated in Tedlar™, a time-tested weather-, wear-, and ultraviolet-resistant material.

"Wiring the unit, panel to battery, is quite simple. Only four wires are used."

Sovonics produces their amorphous cell panels very much like newsprint. A roll of stainless steel is on one end of the proprietary continuous roll-to-roll process, and on the other end, out comes a 40 kilowatt roll of solar cells. In this continuous process, layer after layer of semiconductor coating builds up a tandem cell 1/100 as thick as a human hair. The substrate is then cut and installed into different frames for their line of panels. This construction results in a panel that is flexible, lightweight, and unbreakable. However, Sovonics does not stop here. In conventional solar panels, the interconnections between the cells have proven a real pain in the neck. Break one of those interconnections, and the panel is dead. Sovonics has moved all the interconnections to the outer edge of the cells, avoiding the former pitfalls.

Sovonics also has added bridging diodes *within* the panel. By feeling along the back side of the panel, you can spot the diode "bumps." In the older crystalline cell panels, if you lose one cell, perhaps to thermal shock, the panel is useless. The bridging diodes will bypass the cell, allowing the panel to continue to supply power. Likewise, in a conventional cell, a shadow falling across a panel will shut down the entire panel. The Sovonics panel will continue to work.

Up to now, the great majority of solar panels on the market have been in glass. Glass is heavy, and no one would argue that glass breaks. The Sovonics panels can be bent, shot with bullets, dropped, walked on, and generally beat up, and still work. Because of the nature of amorphous silicon cells, they

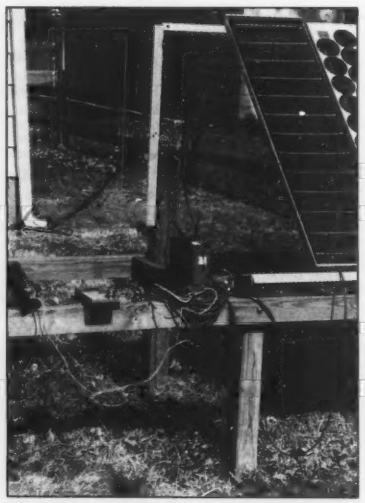


Photo A. Test setup of the entire Antennas West solar package. Note the difference between the P-201 and the corner of the Arco 16-2000.

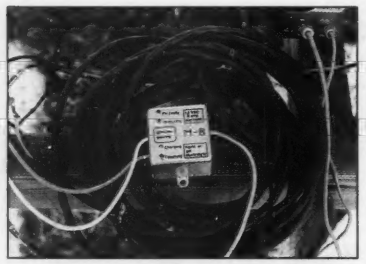
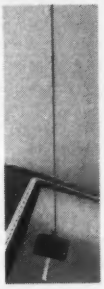


Photo B. The small charge controller that comes with the package is rated at eight Amps.

Photo C. Current of 880 milliamps from a morning sun. Notice shadows under the array. The Sovonics P-201 is in the foreground.

Look at our MOBILE MARK™ "ON WINDOW" Line

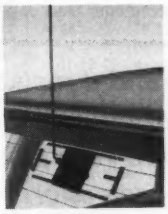
PATENTED



VHF (140-175)
- *No Hole*
- *Easy to Mount*
- *Rugged*
- *Superior Performance*
- *Radiator Snaps On and Off*
- *Competitively Priced*

UHF (420-520)
- *3 db gain*
- *No Hole*
- *Easy to Mount*
- *Rugged*
- *Superior Performance*
- *Radiator Snaps On and Off*
- *Competitively Priced*

Cellular/Trunking (800-895 Mhz)



- *3db Gain*
- *No Hole*
- *Easy to Mount*
- *Rugged - Goes through Car Wash Without Removal*
- *Superior Performance*
- *Broad Bandwidth*
- *Small Size*
- *Competitively Priced*

MOBILE MARK, INC COMMUNICATIONS ANTENNAS

3900-B River Road
Schiller Park, IL 60176
312-671-6690

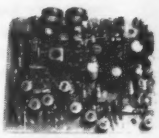
brings imagination and innovation to antennas ..... and has been since 1948 !!

CIRCLE 163 ON READER SERVICE CARD

AMATEUR TELEVISION

SURVIVES 100,000 FT. FALL

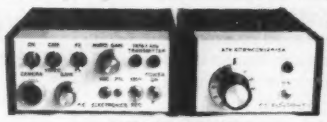
KPA5 1 WATT ATV XMTR ON 434 MHZ WORKED PERFECTLY IN WB8ELK LIVE CAMERA BALLOON THROUGH 100,000 FT AND BACK TO CONTINUE RUNNING EVEN AFTER FREE FALL IMPACT IN THE MOJAVE DESERT! VIDEO SEEN FOR 300 MILES.



KPA5-E board $169

Shouldn't your ATV transmitter be as reliable? Weather you want to put one in a balloon, R/C model, Robot, use as portable ATV xmtr, or get one in our ready to go TX70-1 for the shack, with P.C. Electronics you *see* the best! Companion receiving downconverter board TVC-2G $49, or ready to go in a cabinet - TVC-4G $89.

TX70-1 XMTR $259



TVC-4G RECV CONV. $89

THE ATV TWINS

Hams, Call or Write for our latest catalog of ATV gear!
Transmitters sold only toTech or higher licensed amateurs varified in latest Callbook or copy of new license. 5/89

(818) 447-4565 m-f 8am-5:30pm pst. Visa, MasterCard

P.C. ELECTRONICS
2522 Paxson Ln Arcadia CA 91006

Tom (W6ORG)
Maryann (WB6YSS)

Hi Pro Repeaters MELCO

MAGGIORE ELECTRONIC LAB.

Manufacturers of Quality Communications Equipment

- **Repeaters**
- **Links**
- **Remote Base**
- **VHF,UHF**
- **Receivers**
- **Transmitters**
- **Antennas**

- **Standard and Computerized Controllers**
- **Standard and Computerized Auto Patches**
- **Duplexers**

Hi Pro 'E' EXPANDABLE REPEATER SYSTEM

- A NEW CONCEPT IN REPEATER DESIGN, THE Hi Pro "E" IS AN EXPANDABLE REPEATER WITH THE FOLLOWING FEATURES: A BASIC REPEATER WHICH WOULD INCLUDE A COMPLETE RECEIVER, TRANSMITTER, COR, FRONT PANEL CONTROLS AND INDICATORS, LOCAL SPEAKER AND MIC JACK AND CAPABLE OF FUTURE EXPANSION. ALL HOUSED IN AN EXTREMELY RUGGED, ENCLOSED, 19-INCH RACK MOUNTABLE CABINET.
- THIS SYSTEM CAN BE EXPANDED AT TIME OF PURCHASE OR CAN BE AN AFTER-PURCHASE ADD ON. THE ADD ONS ARE—HIGHER POWER, 110/220 VAC POWER SUPPLY, IDENTIFIER, AUTO PATCH, OR COMPUTER CONTROLLERS. IN ADDITION TO THESE ADD ONS AN ADDITIONAL RECEIVER AND TRANSMITTER CAN BE MOUNTED INTERNALLY FOR USE AS CONTROL LINKS, REMOTE BASE OR DUAL BAND OPERATION, ETC.
- AN EXTENSION PANEL IS AVAILABLE FOR LOCAL MONITORING OF THE REPEATER AND CONTAINS ALL NECESSARY METERING, STATUS LIGHTS AND INDICATORS. ALL ADD ONS ARE AVAILABLE FROM THE COMPANY AND ARE COMPLETE INCLUDING INSTRUCTIONS.

MAGGIORE ELECTRONIC LAB.

600 Westtown Rd. West Chester, PA 19382 Phone (215) 436-6051 Telex 499 0741 MELCO

WRITE OR CALL FOR OUR COMPLETE CATALOG

work quite well in diffused light, such as hazy humid weather or cloudy skies. The crystalline cells will fall flat on their faces under those conditions.

Antennas West makes use of the Sovonics P-201 panel. It is rated at 23 Watts under peak sun conditions. This boils down to about 1.6 Amps for battery charging. The P-201 measures one foot wide by four feet long, and weighs under five pounds. Antennas West supplies a 30-foot cable that is attached at one end to the P-201 panel. This is a four conductor cable in which two sets of the wires are connected together. This reduces loss from the panel-to-controller cable.

Setting Up the Panel

Enough on the theory of operation. The Antennas West solar module kit was extremely easy to set up and get running. When you first open the box you'll be greeted by the Sovonics P-201 panel. If you have ever seen one of the crystalline cell panels, all covered with tempered glass and framed in 1/4-inch thick aluminum angle stock, you'll be in for a shock.

The panel looks like it is made of printed cardboard. You can twist and bend the entire panel. Give the center of the panel a good thump with your hand and it yields to the pressure applied. You will also find a bag full of all kinds of things. Terminal strips, nuts, bolts, and various other goodies. The Antennas West solar package is very complete. All you need is a radio and battery. They even included a tube of RTV sealer for repairs and for gluing the panel down on a flat surface. Since the connecting wire between the panel has already been attached, all you need to do is insert the charge controller between the panel and the battery. You will also find a rather large technical manual.

Instructions

The manual needs some attention. It is printed directly from a dot matrix printer. Instead of opening like a book or magazine, the manual opens end to end, much like the old "Thunder Chief" yellow tablets of my school days. The pages of the manual are gummed together at the top. I worry that the pages will fall out under constant use. Unlike the manual that came with your tribander, there is so much information for the new user of solar power, I can envision many a newcomer reading and re-reading the manual. My manual had several typos, and on several pages, some of the print was unreadable. Perhaps the ribbon in the printer got out of its guide when the manual was printing. All and all however, the manual is quite complete. In fact, I talked with Jim Stevens, of Antennas West, about changing the layout of the manual so it would open like a magazine. I also suggested adding three hole punch-outs to each page.

I was very glad to find out what you can and cannot operate from the 23 Watt P-201 panel. 23 Watts is not much power, unless you know how to put it to use. And I'm not talking about running QRP equipment, either, but also 200 Watt radios. The manual goes into great detail on computing your power consumption at your location. A very good section on battery selections, along with charge control, rounds out the manual. The technical manual is 41 pages long.

The Antennas West solar kit also comes with a series switch charge controller. This will keep the battery(ies) from overcharging. By monitoring the terminal voltage of the battery, a relay will open up and stop all flow of current to the battery, preventing overcharging. The controller will then monitor the voltage of the battery and will turn on the series relay to maintain the full charge terminal voltage. This "pulse" charging will reduce battery gassing considerably. The controller works super well with the sealed gell/cell batteries. The controller was designed by KA8IDB. It is potted in epoxy and is quite small—about two inches square. Wiring the unit, panel to battery, is quite simple. Only four wires are used. The charge controller can be mounted on a wall with the wood screws supplied or with some double-backed tape, also supplied.

"It's lightweight, vandal resistant (repeater operators take note), and should provide year after year of trouble-free energy generation."

Since my entire station operates from solar power, I isolated some of my gear to operate directly from the Antennas West solar kit. I used my Argosy transceiver and a KDK 2 meter mobile. A 50 Ah gell/cell battery was used for energy storage. I mounted the P-201 alongside my other panels on the array rack. This rack is tilted to optimize my location.

The P-201 is rated at 23 Watts peak output. This happens when the isolation from the sun is 1000W/m² at 42°C, a widely accepted standard. In real life, we can count that amount of sun on one hand, (if you live in Ohio). Using digital current and voltmeters, I measured maximum current of 1.4 Amps several times. Depending on the state of charge of the battery and the isolation of sunlight, you may not see the rated 23 Watts. In mid-March, I averaged close to 18 Watts. No question, had I lived in the Sun Belt, I would have received higher Watts/day.

Operating my 100 Watt Argosy and 2 meter FM radio, I had no trouble maintaining communications. I operated several hours a week, mostly on CW. The FM gear was used more, about 10 hours per week. Had I operated more, or changed to a higher power radio, I could have added more panels in parallel to boost charge current. No question about it, 23 Watts is not much, but that is the beauty of solar power—You can add panels as your needs grow.

For larger power requirements, I would recommend the use of a larger Sovonics panel, along with a charge controller that will handle the higher current. You can purchase additional P-201 panels from Antennas West for about $200. That breaks down to about $8 per peak Watt. You can do better, *if* you know what to buy and how to interconnect the different systems together.

Drawbacks

Were there some things that I did not care for? The Sovonics panel, as super tough as it is, is a little rough around the edges in quality. I have talked with the people at Sovonics and they acknowledge the quality control problem. New equipment is being installed to improve quality control. The panel that came with the review unit, while working perfectly electrically, had some workmanship defects. There were holes that were drilled off-center on the back side of the panel. Since the panel does not have a frame as such, the aluminum sheet that the laminate is bonded to was not folded over properly.

You should be aware of some of the down sides to amorphous silicon solar panels. Since Sovonics panels are made using amorphous silicon, they suffer (as do all amorphous silicon solar cells) from a small degree of degradation. The panels are not as stable as their crystalline counterparts. The power output will drop as they age and then level off, usually within the first 30 days or so. Sovonics panels degrade about 10% of their rated power. The stainless steel substrate used by Sovonics has an "annealing" effect on the cells. It seems that after an initial drop in power, the panel will come back up slightly. That is why Sovonics rates their panels lower than other manufacturers. This gives the end user a more realistic power capacity.

Because amorphous silicon panels are less efficient, you'll require twice the surface area for the same amount of energy produced using a crystalline cell panel.

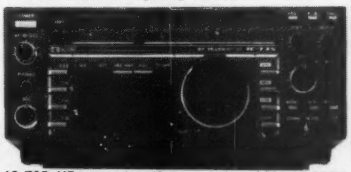
All and all, I was very happy with the Antennas West QRV solar package. After you get used to the strange appearance of the Sovonics panel, you'll find it a strong performer. It's lightweight, vandal resistant (repeater operators take note), and should provide year after year of trouble-free energy generation. Even if you don't want to limit yourself to only 23 Watts, just keeping the module in the closet will provide emergency power for those times when you may need electricity most. If you like the idea of using solar energy to help power your shack but don't want to spend a lot of time and money, the Antennas West QRV solar package is ideal. And if you want to keep connected to the grid, but like the idea of a small emergency power supply, again this solar package fits the bill.

The Antennas West QRV solar package is the most complete and thought-out design for the newcomer to solar electric power on a small scale.

HF Equipment	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner	3149.00	2789
IC-781 Xcvr/Rcvr/ps/tuner/scope	5995.00	Call

IC-761 Xcvr/Rcvr/ps/tuner	2699.00	2369
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter	149.00	139.95
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	109.95
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	1469
PS-35 Internal power supply	219.00	199.95
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	109.95
FL-53A 250 Hz CW filter (2nd IF)	115.00	109.95
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	



IC-735 HF transceiver/SW rcvr/mic	1099.00	989.95
PS-55 External power supply	219.00	199.95
AT-150 Automatic antenna tuner	445.00	369.95
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	
IC-725 Ultra compact HF xcvr/SW rcvr	949.00	849.95

Other Accessories	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	1699
EX-627 HF automatic antenna selector	315.00	279.95
PS-15 20A external power supply	175.00	159.95
PS-30 Systems p/s w/cord, 6-pin plug	349.00	319.95
MB Mobile mount, 735/751A/761A	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
PP-1 Speaker/patch	179.00	164.95
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	139.95
AT-100 100W 8-band auto. ant. tuner	445.00	389.95
AT-500 500W 9-band auto. ant. tuner	589.00	519.95
AH-2 8-band tuner w/mount & whip	659.00	589.95
AH-2A Antenna tuner system, only	519.00	449.95
GC-5 World clock	91.95	79.95

ICOM

★ Large Stocks
★ Fast Service
★ Top Trades
at AES®

VHF/UHF base multi-modes	Regular	SALE
IC-275A 25W 2m FM/SSB/CW w/ps	1299.00	1099
IC-275H 100W 2m FM/SSB/CW	1399.00	1199
IC-375A 25W 220 FM/SSB/CW (c/o)	1399.00	799.95
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	1199
IC-475H 75W 440 FM/SSB/CW	1599.00	1369
IC-575A 25W 6/10m xcvr w/ps	1399.00	1129
IC-575H 100W 6/10m xcvr	1699.00	1499

VHF/UHF/1.2 GHz Mobiles	Regular	SALE
IC-37A 25w 220 FM/TTP mic (c/o)	499.00	329.95
IC-47A 25w 440 FM/TTP mic (c/o)	549.00	369.95
PS-45 Compact 8A power supply	145.00	134.95
UT-16/EX-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28A 25W 2m FM, TTP mic	469.00	409.95
IC-28H 45W 2m FM, TTP mic	499.00	439.95
IC-38A 25W 220 FM, TTP mic	489.00	349.95
IC-48A 25W 440-450 FM, TTP mic	509.00	449.95
HM-14 Extra TTP microphone	59.00	
UT-28 Digital code squelch	39.50	
UT-29 Tone squelch decoder	46.00	
HM-16 Speaker/microphone	34.00	
IC-228A 25W 2m FM/TTP scan mic	509.00	449.95
IC-228H 45W 2m FM/TTP scan mic	539.00	479.95
IC-448A 25W 440 FM/TTP mic	509.00	449.95
UT-40 Pocket beep function	45.00	
IC-900A Transceiver controller	639.00	569.95

★ Package Special . . .
IC-900A Transceiver controller with **UX-29H** 2m/45W and **UX-39A** 220/25W band units.
$969.95

UX-19A 10m 10W band unit	299.00	269.95
UX-29A 2m 25W band unit	299.00	269.95
UX-29H 2m 45W band unit	349.00	319.95
UX-39A 220MHz 25W band unit	349.00	299.95
UX-49A 440MHz 25W band unit	349.00	319.95
UX-59A 6m 10W unit	349.00	319.95
UX-129A 1.2GHz 10W band unit	549.00	499.95
IC-1200A 10W 1.2GHz FM Mobile	699.00	599.95
IC-1271A 10W 1.2GHz SSB/FM xcvr	1269.00	1099
IC-3200A 25W 2m/440 FM/TTP (c/o)	695.00	469.95
UT-23 Voice synthesizer	34.99	
IC-3210A 25w 2m/440 FM/TTP	739.00	649.95
AH-32 2m/440 Dual Band antenna	39.00	
AHB-32 Trunk-lip mount	35.00	
Larsen PO-K Roof mount	20.00	
Larsen PO-TLM Trunk-lip mount	22.00	
Larsen PO-MM Magnetic mount	22.00	
RP-1210 1.2GHz 10W 99 ch FM xcvr	1529.00	1349
RP-2210 220MHz 25W repeater	1649.00	1399
RP-3010 440MHz 10W FM repeater	1299.00	1149

Due to the size of the ICOM product line, some accessory items are not listed. If you have a question, please call. All prices shown are subject to change without notice.

Top Trades ! • We'll take your Clean Late Model gear in trade towards New ICOM Equipment.
Write or Call for our Quote Today!

MasterCard VISA

Hand-helds	Regular	SALE
IC-2A 2-meters	289.00	259.95
IC-2AT with TTP	319.00	279.95
IC-02AT/High Power	409.00	349.95
IC-04AT for 440 MHz	449.00	389.95
Ic-u2AT for 2m w/TTP	329.00	279.95
IC-u4AT 440 MHz, TTP	369.00	289.95
IC-2GAT for 2m, TTP	429.00	379.95
IC-4GAT 440MHz, TTP	449.00	399.95
IC-32AT 2m/440MHz	629.00	559.95

FREE Battery! . . .
BP-23 600ma/8.4V • No Charge with purchase of IC-u2AT or IC-u4AT

Aircraft band handhelds	Regular	SALE
IC-12AT 1W 1.2GHz FM HT/batt/cgr/TTP	473.00	369.95
IC-12GAT 1W 1.2GHz HT/batt/cgr/TTP	529.00	469.95
A-2 5W PEP synth. aircraft HT	525.00	479.95
A-20 Synth. aircraft HT w/VOR	625.00	569.95

Accessories for all except micros	Regular
BP-7 425mah/13.2V Nicad Pak - use BC-35	79.00
BP-8 800mah/8.4V Nicad Pak - use BC-35	79.00
BC-35 Drop in desk charger for all batteries	79.00
BC-16U Wall charger for BP7/BP8	21.25
LC-11 Vinyl case for Dlx using BP-3	20.50
LC-14 Vinyl case for Dlx using BP-7/8	20.50
LC-02AT Leather case for Dlx models w/BP-7/8	54.50

Accessories for IC and IC-O series	Regular
BP-2 425mah/7.2V Nicad Pak - use BC35	49.00
BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50
BP-4 Alkaline battery case	16.00
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00
CA-5 5/8-wave telescoping 2m antenna	19.95
CP-1 Cig. lighter plug/cord for BP3 or Dlx	13.65
CP-10 Battery separation cable w/clip	22.50
DC-1 DC operation pak for standard models	24.50
MB-16D Mobile mtg. bkt for all HTs	25.99
LC-2AT Leather case for standard models	54.50
RB-1 Vinyl waterproof radio bag	35.95
HM-9 Speaker microphone	47.00
HS-10 Boom microphone/headset	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
HS-10SB PTT unit for HS-10	24.50
SS-32SMP Commspec 32-tone encoder	27.95

For other HT Accessories not listed please CALL

Receivers	Regular	SALE
R-71A 100kHz to 30MHz receiver	$999.00	869.95
RC-11 Infrared remote controller	70.99	
FL-32A 500 Hz CW filter	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-44A SSB filter (2nd IF)	178.00	159.95
EX-257 FM unit	49.00	
EX-310 Voice synthesizer	59.00	
CR-64 High stability oscillator xtal	79.00	
SP-3 External speaker	65.00	
CK-70 (EX-299) 12V DC option	12.99	
MB-12 Mobile mount	25.99	
R-7000 25MHz to 2GHz scan rcvr	1199.00	1029
RC-12 Infrared remote controller	70.99	
EX-310 Voice synthesizer	59.00	
TV-R7000 ATV unit	139.00	129.95
AH-7000 Radiating antenna	99.00	

HOURS • Mon. thru Fri. 9-5:30; Sat. 9-3
WATS lines are for Quotes & Ordering only, use Regular line for other Info & Service dept.

Order Toll Free: 1-800-558-0411 In Wisconsin (outside Milwaukee Metro Area) 1-800-242-5195

AMATEUR ELECTRONIC SUPPLY® Inc.

4828 W. Fond du Lac Avenue; Milwaukee, WI 53216 • Phone (414) 442-4200

AES® BRANCH STORES — Associate Store

WICKLIFFE, Ohio 44092
28940 Euclid Avenue
Phone (216) 585-7388
Ohio WATS 1-800-362-0290
Outside Ohio 1-800-321-9594

ORLANDO, Fla. 32803
621 Commonwealth Ave
Phone (407) 894-3238
Fla. WATS 1-800-432-9424
Outside Florida 1-800-327-1917

CLEARWATER, Fla 34625
1898 Drew Street
Phone (813) 461-4267
No In-State WATS
No Nationwide WATS

LAS VEGAS, Nev. 89106
1072 N. Rancho Drive
Phone (702) 647-3114
No In-State WATS
Outside Nevada 1-800-634-6227

CHICAGO, Illinois 60630
ERICKSON COMMUNICATIONS
5456 N. Milwaukee Avenue
Phone 312/631-5181
Outside Illinois 1-800-621-5802

Decoding OSCAR Telemetry — Part II —

by James R. Miller G3RUH

Part I of this article, (in the May '89 issue of *73*) covered telemetry info on OSCAR-9 (UoSAT-1), OSCAR-11 (UoSAT-2), and OSCAR-13 (P3C). This final part covers telemetry info on Fuji-OSCAR-12 (F-0-12), and some birds yet to be launched: UoSAT-D and the Microsats. (Note that F-O-12 is NOT the same as UoSAT-D.)

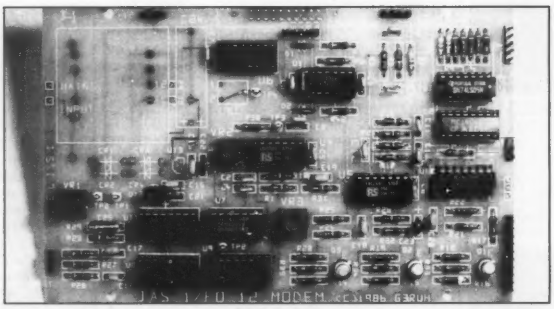


Photo A. FO-12 PSK Packet Radio Modem. This uses regular CMOS/TTL chips and no hard-to-get parts. This modem is used with the FO-12 flying BBS and AMSAT-NA's forthcoming MicroSats. PSK modems are also used for PSK packet experiments terrestrially, through OSCAR-13's voice transponder, and even meteor scatter.

Fuji OSCAR-12

General: JAS-1 or Fuji-OSCAR-12 was launched on August 12, 1986 from the southern tip of Japan. It carries two transponders: a traditional one for SSB/CW, and the world's first spaceborne packet radio BBS. In orbit 1600 km (1000 miles) high, it's inclined at 50 degrees to the equator with a period of 120 minutes. It offers users an aggregate of two hours communication per day. When in SSB/CW mode, it sends telemetry in Morse code on 435.795 MHz. When in the digital mode, telemetry and traffic is in the AX.25 packet format on 435.910 MHz. Nowadays, FO-12 is somewhat troubled by insufficient power from the solar panels to support the digital mode full-time. The improved JAS-2 is in preparation and, based on the experience of its predecessor, it should be highly successful.

Since the digital mode supports a packet mailbox, users can also transmit data in the 2 meter band to the satellite. The modulation format, however, is *not* the same as for terrestrial packet. Nevertheless, you do need a packet radio Terminal Node Controller (TNC).

Data Transmitted: In the digital mode, FO-12 sends its telemetry in "unconnected" AX.25 packet frames, which appear on your terminal as seen in Figure 1. You will see that the telemetry contains 40 numbers which you can decode into voltages, currents, temperatures, status points, etc., using the published equations. For example, the first item is "Total Solar Array Current, mA," and decodes as I = 1.91 x (N-4). Setting N = 275, you find that this current is 518 mA.

In addition to the telemetry data, you would also be able to monitor the packet traffic. This looks no different from the familiar terrestrial scene, except it's faster!

Telemetry Format: In contrast to conventional local packet radio, which uses two tones (AFSK) to signal binary "0" or "1," FO-12 uses phase shift keying (PSK) modulation. The carrier phase is changed by 180 degrees (inverted) when a change in binary level is signaled.

The downlink carrier on 435.910 MHz passes through a balanced modulator driven by the AX.25 digital data at 1200 bits/s to generate PSK.

The uplink is different: 1200 bits/s data is exclusive-ORed with its 1200 Hz clock (called "Manchester" coding), and this audio is transmitted FM on 145.850, 145.870, 145.890, or 145.910 MHz.

Telemetry Demodulation: A PSK demodulator consists of a phase reference derived from the received audio with a special phase-locked loop (PLL), and a phase detector to extract the phase changes and convert them to digital bits. In addition, the received signal is subject to 16 kHz total Doppler shift due to the spacecraft's movement, at a maximum rate of 40 Hz per second. Tuning the receiver by hand to follow this is practically impossible, so an auto-tune circuit is essential, especially if you want to turn antennas and operate a keyboard as well.

The G3RUH FO-12 PSK Modem provides all the above functions plus an uplink modulator. It has been available since 1986, with about 500 presently in use. This modem can also be used for experimental PSK work either terrestrially or through OSCAR-13's voice transponder. A power advantage of some 10 dB over normal packet signaling is typical.

Decoder/Modem Specifications:

Downlink—Input 50 mV to 5V RMS audio from SSB/CW receiver. PSK demodulator. Output TTL digital, 1200 bps.

Uplink—Input TTL digital, 1200 bps; Output, 1200 bps Manchester encoding modulator to mike level.

Connects—To AX.25 TNC's "modem disconnect jack." Suitable for TNC-2 and derivatives, such as TNC-200, TNC-220, Tiny-2, PK-80, PK-87, PK-88, etc.

Digital AFC—Tracks changing Doppler shift via the up/down lines of all known ICOM, Trio/Kenwood, and Yaesu receivers.

Controls—Auto-tune on/off, PLL bandwidth, Lock/Tune/Power LEDs.

Set-up—Three trim pots; PLL frequency, ½ supply voltage, and up/down tuning sensitivity set.

Power/PCB—12V @ 40 mA. Built-in AC PSU options. Double-sided plated through PCB, 160 x 100 mm. 11 ICs, 40 resistors, 25 capacitors.

Availability—The PCB is available from AMSAT-UK (17 pounds airmail). You may also order it from AMSAT-VK and Project OSCAR. RadioKit sells the PCB plus full kit of parts. AMSAT-NA stocks no satellite products, though this could change in response to demand. Phone to check. All addresses and numbers are at the end of this article.

Associated Equipment: You must use a 70 cm SSB radio to receive FO-12 on 435.910 MHz. Tuning rate should preferably be 20 Hz/step or better. You can use 100 Hz steps, but at the expense of data errors when badly mistuned. You can take audio direct from the external speaker socket. Some receivers will

ATV CONVERTERS • HF LINEAR AMPLIFIERS

DISCOVER THE WORLD OF FAST SCAN TELEVISION

AMATEUR TELEVISION CONVERTERS
ATV2 420–450 ..... $ 44.95 Kit
ATV3 420–450 (GaAS–FET) ..... $ 49.95 Kit
ATV4 902–928 (GaAS–FET) ..... $ 59.95 Kit

AUDIO SQUELCH CONTROL for ATV
SIL ..... $ 39.95 Kit

2 METER VHF AMPLIFIERS
35 Watt Model 335A ..... $ 79.95 Kit
75 Watt Model 875A ..... $119.95 Kit
Available in kit or wired and tested

HF AMPLIFIERS per MOTOROLA BULLETINS
Complete Parts List for HF Amplifiers Described in the MOTOROLA Bulletins
AN758 300W ..... $160.70 EB63 140W ... $ 88.65
AN762 140W ..... $ 93.25 EB27A 300W .. $139.20
AN779 20W ..... $ 83.79 EB104 600W .. $448.15

NEW!! 200 WATT 10–150 MHz Amplifier

POWER SPLITTERS and COMBINERS (2–30MHz)
600 Watt 2–Port $69.95
1200 Watt 4–Port $79.95

100W 420–450 MHz PUSH–PULL LINEAR AMPLIFIER – SSB–FM–ATV
KEB67–PK (Kit) $129.95
KEB67–PCB (PC Board) ..... $ 18.00
KEB67–I (Manual) ..... $ 5.00

For detailed information and prices, call or write for our free catalog.

FERROXCUBE DEVICES
VK200–20/4B RF Choke ..... $ 1.20
56–590–65–3B Ferrite Bead ..... $ .20

HEAT SINK MATERIAL
Model 99 Heat Sink(6.5x12x1.6) ..... $ 22.00
CHS–6 Copper Spreader(6x6x1/4) ..... $ 18.00
Add $2.00 additional shipping.

We also stock Hard–to–Find parts
CHIP CAPACITORS
METALCLAD MICA CAPACITORS
RF POWER TRANSISTORS
MRF141G $209.20
MRF151G $186.80
MINI–CIRCUIT MIXERS
SBL–1 ..... $ 6.50
SBL–1X ..... $ 7.95
ARCO TRIMMER CAPACITORS

Add $ 2.00 for shipping and handling.

VISA

CCI Communication Concepts Inc.
121 Brown Street • Dayton,Ohio 45402 • (513) 426-8600
FAX (513) 429–3811

master charge

CIRCLE 99 ON READER SERVICE CARD

DIGITAL VIDEO STABILIZER
REMOVES ALL VIDEO COPY PROTECTION

While watching rental movies, you will notice annoying periodic color darkening, color shift, unwanted lines, flashing or jagged edges. This is caused by the copy protection jamming signals embedded in the video tape, such as Macrovision copy protection. THE DIGITAL VIDEO STABILIZER COMPLETELY ELIMINATES ALL COPY PROTECTIONS AND JAMMING SIGNALS AND BRINGS YOU CRYSTAL CLEAR PICTURES.

WARNING
THE DIGITAL VIDEO STABILIZER IS INTENDED FOR PRIVATE HOME USE ONLY. IT IS NOT INTENDED TO COPY RENTAL MOVIES OR COPYRIGHTED VIDEO TAPES THAT MAY CONSTITUTE COPYRIGHT INFRINGEMENT.

FEATURES
- Easy to use and a snap to install
- The best and most exciting video stabilizer in the market
- State-of-the-Art Microchip Technology
- 100% automatic
- Works on all VCRs & TVs
- Similar units sold elsewhere for $99
- Light weight & compact
- Uses a standard 9 Volt battery (lasts 1 - 2 years); battery not included
- Fast Shipping
- Air Shipping Available
- UNCONDITIONAL 30 days money back guarantee
- 1 year warranty

Special
$49.95 ea
($4 p&h)

ToOrder: Visa, M/C, COD M-F: 9-6
1-800-445-9285 or 516-568-9850
SCO Electronics Inc. Dept.CXX
581 W.Merrick Rd Valley Stream NY 11580

A X M Incorporated
Serving the radio amateur who needs more than an amateur radio.
11791 Loara Street, Suite B
Garden Grove, California 92640
Tel: (714) 638-8807 FAX: (714) 638-9556

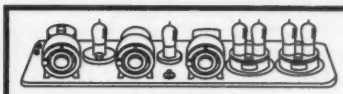
WE HAVE WHAT YOU WANT!

Yes, the HR 2600 is now **IN STOCK** and ready for immediately delivery.

Lots of new features including built in repeater split.

CALL NOW FOR PRICE

CIRCLE 243 ON READER SERVICE CARD



IF YOU BUY, SELL OR COLLECT OLD RADIOS, YOU NEED...

ANTIQUE RADIO CLASSIFIED

Antique Radio's Largest-Circulation Monthly Magazine

Articles - Classifieds - Ads for Parts & Services
Also: Early TV, Ham Equip., Books, Telegraph, 40's & 50's Radios & more...

Free 20-word ad each month. Don't miss out!
Free Sample. 6-Month Trial - $11.
1-Year: $19 ($28 by 1st Class). Foreign - Write.
A.R.C., P.O. Box 2-E4, Carlisle, MA 01741

CIRCLE 271 ON READER SERVICE CARD

NOW HEAR THIS

FINALLY! High-Powered Sound from your HT.

- 10 DB of Audio Gain
- 3.5 inch Oval Speaker
- Automatic Shut-OFF
- Internal NiCad Charger
- External Power 5-15 VDC

$29.95

Model HTS-1

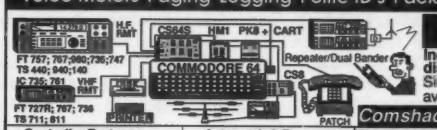
Naval ELECTRONICS INC.
5417 Jet View Circle, Tampa, Florida 33634
Phone: (813) 885-6091 Telex: 289-237 (NAVL UR) Fax: (813) 885-3789

CIRCLE 349 ON READER SERVICE CARD

Engineering Consulting's computer controlled Ham Shack Now display Ultra's screen via packet with automatic update!

Ultra Comshack 64 Repeater Controller

HF & VHF Remote Base*Autopatch*CW Practice*Rotor Control *Voice Meters*Paging*Logging*Polite ID's*Packet Control



Model CS64S $ 349.95
Includes: interface, disk, cables, Manual
Simplex version available on request

Comshack 64 Options

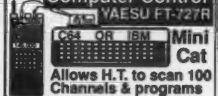
Controller Features
*Change variables remotely from touchtones or Packet
*Unlimited voice vocabulary!
*Alarm Clock, auto execute
*Individual 4 digit user codes
*Disk & Printer logging of users, tel #'s, lapsed time
*18 Rotating Polite ID's
*16 External relay controls
*2-tone & sub tone Paging
*CW Practice with voice
*Security mode, T.tone mute
*Voice announces each user call sign when logging on

Autopatch & Reverse
*1020 (18 digit) tel #'s stored
*Quick dial & answer
*Directed,general page
*Selected restricted patch
*Telephone control input

Dual Combined Remotes
*20 Macro memories
*Scan up/down; 100Hz steps
*Monitor & lock modes
*Operate splits, combine HF & VHF radios as Dual VFO's
*Automatic mode selection
*Talking S Meter; Voltmeter
*Voice Beacon rotating msg

External relays; 3 DPDT relays +5 Open Col. Tr. Sw...CS 8 ..... $79.95
*Rotor control D.C. to digital display & Voice; for all rotors.HM1 ..... $49.95
*Packet & BBS; Voice Meters & Alarm Inputs; 8 On/Off PK8 .$149.95
*Slave Packet interface & cable Links PK8 to 2nd C64 PK1 ....$49.95
*EPROM Autoboot, custom PROM cart with your system.CART.$ 99.95
*C64 & 1541 12V.Switching supply crystal controlled ...DCPS..$119.95
*System Manual ;Refunded with purchase of CS64S.....MN1....$ 15.00

Computer Control YAESU FT-727R



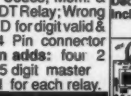
Allows H.T. to scan 100 Channels & programs
H.T. for field use! Digital "S" Meter; comment fields; auto resume & delay; Scan Lockouts; Loads FT727 in 15 sec. Hardware, cables, & disk included for C64 or IBM
Model 727 $39.95

Touchtone Decoder
4 digit sequence; & QUAD expansion 4 relay option

8/20 V & audio in; Field Program 50,000 Codes; Mom. & Latching; DPDT Relay; Wrong digit reset; LED for digit valid & latch; inc. 24 Pin connector
QUAD option adds: four 2 Amp. relays; 5 digit master on/off control for each relay.
TSDQ $79.95 QUAD $99.95

Decode-A-Pad
Touchtone to RS232 300 Baud interface

Use with all computers
Decodes 16 touchtones
Includes Basic program
DAP $ 89.95

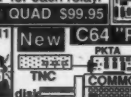


DCPS $119.95

AUDIO BLASTER [C02;04;2AT;FT727;411 U16;FT209;109;73;23

Module installs inside all H.T's: 1 watt audio amp ! When it needs to be loud! Installs in 15 Min. Used by police, fire!
Model AB1S $22.95

New C64 "Packet Talker"



Stores messages (BBS) on disk for up to 300 users; touchtone commands recall & speak messages. Interface to repeaters or for individual use; Works all TNC's; C64 or 128; gives your Packet terminal a voice! Inc. disk & interface
PKTA $189.95

ENGINEERING CONSULTING
583 CANDLEWOOD ST.
BREA, CA. 92621
TEL:714-671-2009 • FAX:714-255-9984

Designation	Name	"Owner"	Mission
MicroSat-A	PACSAT	AMSAT-NA	Packet Radio BBS (PACSAT)
MicroSat-B	DOVE	BRAMSAT (Brazil)	Voice synthesis experiment
MicroSat-C	NUSAT	Weber State Univ	CCD TV Camera Experiment
MicroSat-D	LUSAT	AMSAT-LU	Packet Radio BBS (PACSAT)

Designation	Downlink	Uplinks MHz	Signaling Format
MicroSat-A	437.050	145.900/920/940/960	AX.25 1200 bps as FO-12
MicroSat-B	145.973	—	BFM Voice
MicroSat-C	437.100	—	AX.25 1200 bps as FO-12
MicroSat-D	437.150	145.840/860/880/900	AX.25 1200 bps as FO-12

Table 1.

have a separate AF output socket on the rear panel that bypasses the volume control. To transmit on the uplinks, you need a 2 meter FM transmitter.

FO-12 is very strong, so you can use a vertical collinear antenna at close range. Many operators favor beam antennas, though, and they will have more than enough gain for practical purposes. Steering in azimuth is then essential, and elevation highly desirable, if you want to be able to observe all passes.

An AX.25 Terminal Node Controller (TNC) is essential for use with a suitable VDU or computer terminal just as for terrestrial packet. You can process telemetry data by hand or by a simple program on the computer. It is *not* possible to display the raw data directly from the modem on a VDU or 1200 baud terminal, as it is in AX.25 packet format.

Reading: The *FO-12 Handbook* contains full descriptions of the satellite and its systems, as well as essential details of telemetry decoding.

Fuji-OSCAR-12 Technical Handbook, AMSAT-UK, London, E12 5EQ, England, 64 pages (obtain from AMSAT-UK, 4 pounds airmail, AMSAT-VK, or Project OSCAR).

Miller J.R., G3RUH, "A Packet Radio PSK Modem for JAS-1/FO-12," *Ham Radio*, February 1987, pp. 8–22.

Microsats

General: Four small Microsats, conceived by AMSAT North America, are presently under construction and testing. Launch is scheduled for the second half of 1989, along with UoSAT-D (and, of course, the primary commercial mission SPOT-2). See Table 1 for a summary of their main features. Their orbits will be circular, much like UoSAT-2's, and polar with a 99-minute period and appearances around 10:30 a.m. and 10:30 p.m. local time. They will be stabilized, Earth-pointing, with strong signals, hopefully requiring only omnidirectional antennas.

At the time of writing this article (February 1989), details of the telemetry data and packet BBS access have not been finalized, but we expect them to be quite straightforward.

Associated Equipment: Since communication with Microsats A/C/D will be identical to communication with FO-12, simply refer to the FO-12 section of this article for details of the equipment you need.

Reading: The Microsats are new, and the concept is evolving fast. The paper by Tom Clark sketches the program from its conception to today, and explains the designs in a very readable and entertaining style.

Clark T., W3IWI, "AMSAT's Microsat/PACSAT Program," *Proceedings of the 7th ARRL Computer Networking Conference*, October 1988, pp. 41–47.

Johnson L.V., WA7GXD, "Microsat Project—Flight CPU Hardware," *Proceedings of the 7th ARRL Computer Networking Conference*, October 1988, pp. 104–106.

Price H., NK6K, and McGwier R., N4HY, "PACSAT Software," *Proceedings of the 7th ARRL Computer Networking Conference*, October 1988, pp. 145–149.

UoSAT-D

General: UoSAT-D is scheduled for launch on Ariane in the second half of 1989, with 4 AMSAT Microsats and the primary commercial mission, SPOT-2.

The orbit will be circular, much like UoSAT-2's, polar with a 99-minute period and appearances around 10:30 a.m. and 10:30 p.m., local time, with strong signals. Hopefully, it will require only omnidirectional antennas.

The downlink frequency will be around 437 MHz FM, and user uplink around 145 MHz FM. UoSAT-D will use a 9600 bits/s data rate in both directions with AX.25 packet radio format.

As above, details of the telemetry and packet BBS access have not been finalized yet, but we expect them to be straightforward. As the number of experienced users grow, we foresee more automated communication.

Telemetry Format: Uplink and downlink will use 9600 bits/s direct FSK. That is, "1" will cause an increase in carrier frequency, and "0" a decrease.

Precisely controlled shaping of the bit transitions will be essential to constrain the data's audio spectrum to under 7 kHz, and to ensure reliable communication through conventional FM radios with a 20–25 kHz radio channel.

The data will also need to be randomized (scrambled) before transmission, and unscrambled again after reception. This is to ensure that no long runs of all "1s" or all "0s" are transmitted, which would be especially error-prone in this modulation arrangement.

Because the audio bandwidth is somewhat wider than the normal voice, signals must go directly from the receiver's FM discriminator to the transmitter's varactor frequency modulator.

Telemetry Demodulation: The G3RUH 9600 Baud Packet Radio Modem was introduced in mid-1988, and by February 1989 some 500 modems were in worldwide circulation for high speed terrestrial packet radio links.

UoSAT-D has an identical modem design onboard. The modem provides all the modulation and demodulation circuits required for UoSAT-D. It's designed for use with a Terminal Node Controller (TNC), typified by the TNC-2, TNC-200, TNC-220, Tiny-2, PK-80, PK-87, PK-88, etc. It's a high performance, full-duplex modem that works with most voiceband NBFM radios, assuming only minor modifications.

A key feature is digital generation of the transmit audio waveform. Precise shaping compensates for the amplitude and phase response of the receiver. This results in a "matched filter" system, which means that the received audio offered to the data detector has the optimum characteristic (eye) for minimum errors. It also allows very tight control of the transmit audio bandwidth.

Decoder Specifications:

Modulation—FM. Audio applied direct to TX varactor. ± 3 kHz deviation gives RF spectrum 20 kHz wide (−60 dB). Fits standard channel easily.

TX Modulator—Eight-bit long digital F.I.R. transversal filter in EPROM for transmit waveform generation (12-bit optional). Gives "brick-wall" audio spectrum. Typically −6 dB at 4800 Hz, −50 dB at 7500 Hz. Allows compensation for distant receiver (the channel) to achieve perfect

```
8J1JAS>BEACON <UI C>:
JAS-1 RA 88/03/19 07:11:58
275 546 684 690 743 876 887 861 002 349
644 001 519 532 538 546 548 538 686 001
710 712 690 746 738 674 921 144 000 000
010 101 100 000 100 000 001 101 111 000

8J1JAS>BEACON <UI C>:
JAS-1 M0 88/03/19 07:12:00
Mailbox available.
Software loaded at 88/03/17 05:25:00
Mode JD Transmitter will be toggled ON/OFF
every two hours using this epoch.
```

Figure 1. FO-12 telemetry in "unconnected" AX.25 packet frames as they appear on your terminal. The telemetry contains 40 numbers which you can decode into voltages, currents, temperatures, status points, etc.

RX eye. Up to 16 TX waveforms (32 optional), jumper selectable. Output adjustable 0–8 V, pk–pk.

Scrambler—(Randomizer): 17-bit maximal length LFSR scrambler. Jumper selectable Data or BERT (bit error rate test) mode.

RX Demodulator—Audio from receiver discriminator, 50 mV–10V, pk–pk. 3rd order Butterworth filter, 6 kHz. Data Detect circuit for use on simplex (CSMA) links. Independent unscrambler. New digital PLL clock recovery circuit with 1/256th bit resolution. Average lock-in time, 50 bits (depends on SNR).

Connects—to AX.25 TNC "Modem Disconnect" jack. Suitable for TNC-2 (and any other, provided the internal modem can be bypassed). Standard TNC digital connections needed: TXData, TXClock (16x bit rate), RXData, Data Detect ("DCD"), GND. TTL levels. RADIO: TX Audio, RX Audio, GND.

Power/PCB—10–15 V DC at 40 mA (CMOS ROMs), 170 mA (NMOS ROMs). Total 19 ICs (13 CMOS, two DACs, two EPROMs). 5 volt regulator and heat sink. 160 x 100mm double-sided, plated through, solder resist, full ground plane. No hard-to-get parts. Instruction booklet, 16 pages.

Availability—The PCB is available from G3RUH (19 pounds airmail plus 6 pounds for the pair of EPROMs, which you may copy). Assembled/tested boards can be obtained from Pac-Comm. RadioKit plans to stock complete kits of parts—check. Project OSCAR will take PCB orders. Canadian outlets are being arranged.

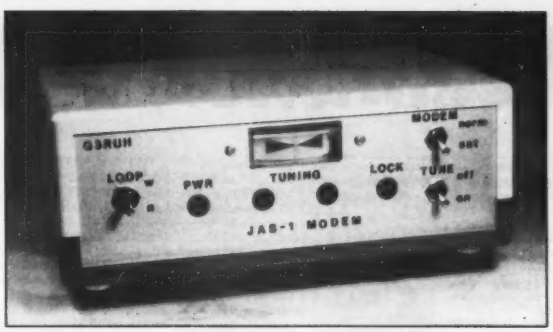


Photo B. FO-12 PSK Modem in cabinet showing controls.

Associated Equipment: You can use a 70 cm FM radio to receive UoSAT-D. Tuning rate can be quite coarse; 1 kHz steps will be adequate. You must take audio direct from the receiver's FM discriminator, implying a minor internal modification. To transmit on the uplink, you need a 2 meter FM transmitter. Apply modulation directly to the varactor to provide true FM. UoSAT-D should be strong. A vertical collinear antenna may be adequate at close range.

An AX.25 Terminal Node Controller (TNC) is essential to use with a suitable VDU or computer terminal, just as for terrestrial packet. It is *not* possible to display the raw data direct from the modem on a VDU or 9600 baud terminal device as it is in AX.25 packet format.

Reading: Ward J., GØ/K8KA, "The UoSAT-D Packet Communications Experiment," *Proceedings of the 7th ARRL Computer Networking Conference*, October 1988, pp. 186–193.

Miller J.R., G3RUH, "9600 baud Packet Radio Modem Design," *Proceedings of the 7th ARRL Computer Networking Conference*, October 1988, pp. 135–140.

CIRCUITS

Number 19 on your Feedback card

Great Ideas From Our Readers

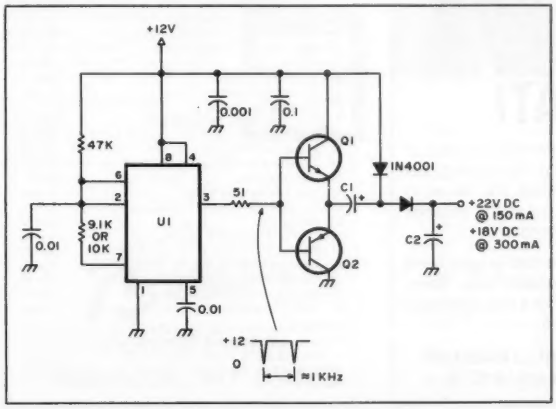
Voltage Doubler Circuit

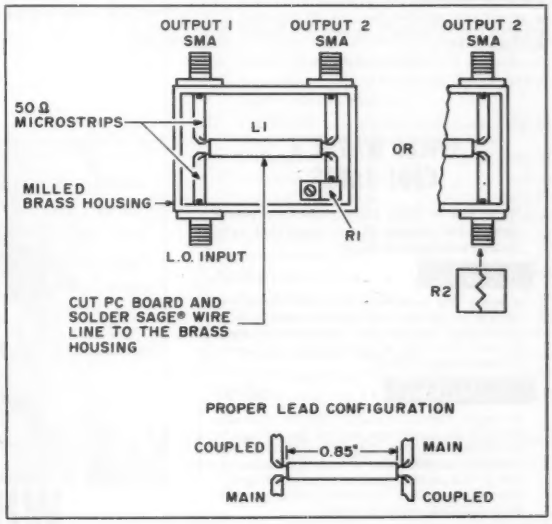
I've used this circuit for the past two years to drive relays of 24 and 28 volts DC from a 12-volt power supply. It is a DC-DC converter which powers a 28-volt DC antenna relay. You can use this circuit with almost any PNP or NPN power transmission. It will work the first time every time.

At hamfests, 28-volt relays often cost less, but because of the voltage rating, most hams don't buy them.

Parts: For U1, you'll need a NE 555 timer. C1 & C2 require 50 µF/25 volts DC. NPN, Q1: TIP29; TIP120; 2N4922; TIP61; TIP110; and 2N4921. PNP, Q2: TIP30; TIP125; 2N4919; TIP62; TIP62; TIP115; and 2N4918.

Chuck Steer WA3IAC
Philadelphia PA





2-Way 2304/2160 MHz Power Divider

Here's a handy little device for 13cm enthusiasts. This allows a user to split the power of the precision LO input into two 50Ω equal power 2160 MHz non-interacting signal sources. Both outputs go to their respective receive and transmit mixers, which are independent of each other.

SMA stands for small miniature adapter, one of only several connectors that should be used at 2 GHz and above. Check also Sealectro, Inc., 225 Hoyt St., Mamaroneck NY 10543, for microwave-band connectors.

Parts: L1 = Sage® 3 dB wireline; R1 = 50Ω microstrip-type termination; R2 = 50Ω termination.

D. Mascaro WA3JUF
Ottsville PA 18942

UNCLE WAYNE'S BOOKSHELF

Aw right, a'ready! NOW, the popular electronics and amateur radio books you've been hounding poor old Uncle Wayne for are here! Now you can build up your hamshack library with these soft-cover favorites...

•The Packet Radio HandBook
by Jonathan L. Mayo KR3T
"...an excellent piece of work. Well worth reading for both the experienced and the new packeteer...the definitive guide to amateur packet operation."
—Gwyn Reedy WIBEL **Only $14.95**

•The Beginner's Handbook of Amateur Radio—2nd Edition ***by Clay Laster***
Combines theory and practice in an easy-to-understand format, and provides information for choosing and installing radio receivers and transmitters, antennas, transmission lines, and test equipment. 400 pages, 291 illustrations **$16.95**

•DX Power: Effective Techniques for Radio Amateurs
by Eugene B. Tilton K5RSG
256 pages, 10 illustrations **$10.00**

•The Magic of Ham Radio ***by Jerry Swank W8HXR***
The next time you want to get someone interested in hamming, lend 'em a copy of Jerry's fascinating book. We've had a fantastic history, helped in all sorts of emergencies–even in Antartic exploration. How about donating one of these to your local school library? **Special $3.95**

•Transmitter Hunting: Radio Direction FindingSimplified
by Joseph D. Moell K8OV and Thomas N. Curlee WB6UZZ
336 pages, 248 illustrations **$17.95**

•The Digital Novice
by Jim Grubbs K9EI
Your guide to the fascinating worlds of communication that have just opened for thousands of amateur radio operators. Now you can learn about everything from Morse code to the latest in packet radio technology. **$8.95**

•RTTY Today ***by Dave Ingram K4TWJ***
The new and only up-to-date RTTY book in existence. Covers all facets of RTTY—RTTY and Home Computers—most comprehensive RTTY guide ever published. Fully illustrated. A must for RTTY fans. 112 pages. **$8.95**

•Shortwave Clandestine Confidential ***by Gerry L. Dexter***
Fascinating reading—new book covers all clandestine broadcasting, country by country—tells frequencies, other unpublished information—spy—insurgents—freedom fighters—rebel—anarchist radio—secret radio—covers all. Current publication. 84 pages **$8.95**

•1989 Passport to World Band Radio
by International Broadcasting Services, Ltd.
You can have the world at your fingertips. You'll get the latest station and time grids, the 1989 Buyer's Guide and more. 416 pages. **$14.95**

•Shortwave Directory ***by Frank Baylin***
A complete directory listing all domestic and foreign station frequencies data from 1.6 MHz to 30 MHz. Over 6,000 listings of Air Forces, Navies, Army, energy, emergency, spy, smugglers, pirate/clandestines, aero federal space, interpol and many more services. Covers all types of transmission modes. SSB, RTTY, FAX, CW and AM. **$17.95**

•The Hidden Signals on Satellite TV
by Thomas P. Harrington and Bob Cooper Jr.
New book shows and tells how to tune in the many thousands of Telephone, Data, Telex, Teletype, Facsimile Signals on most of the TV Satellites, covers equipment, hook-ups, where to tune. Only book covering these secret signals on the satellites, plus all subcarriers. 234 pages. **$19.95**

•GGTE Morse Tutor
Floppy disk for IBM PC, XT, AT and compatibles. Learn the International Morse code or improve your capabilities. One diskette will take you from beginner through extra class in easy self-paced lessons. Standard or Farnsworth mode. Code speeds from 1 to over 100 words per minute. **$20.00**

•The Commodore Ham's Companion ***by Jim Grubbs K9EI***
160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! **$9.95**

•Master Handbook of 1001 Circuits—Solid-State Edition ***by Kendall Webster Sessions***
With this outstanding reference in hand, electronics hobbyists and professionals will never have to search for schematics again. Completely updated, the book is thoroughly indexed and all 1001 circuits are clearly illustrated. 420 pages. **$19.95 soft cover**

•World Press Services Frequencies (RTTY) ***by Thomas Harrington W8OMV***
A comprehensive manual covering Radioteletype news monitoring—contains all information—antenna, receivers, terminal units, plus three extensive frequency lists. Covers 65 World Press Services broadcasting in English. "The Original Press Book." 84 pages. **$8.95**

•Radio Handbook, 23rd Edition ***William I. Orr W6SAI***
(Hard cover only) This book is filled with 840 pages of everything you wanted to know about radio communication. You will get an in depth study of AC/DC fundamentals, SSB, antennas, amplifiers, power supplies and more. **$29.95**

•Basic AC Circuits ***by Stanley R. Fulton/John Rawlins***
A step by step approach for the beginning student technician or engineer. Covers concepts, terms and mathematics required to understand AC circuit problems in an easy to read format. **$24.95**

•Easy-up Antennas for Radio Listeners and Hams ***by Edward M. Noll***
Would you like to learn how to construct low-cost, easy-to-erect antennas? Easy-Up Antennas will help you do just that. **$16.95**

•Forrest Mims' Circuit Scrapbook II ***by Forrest Mims, III***
From the articles in this book you will learn how-to information that will enable you to experiment with MOSFET, analog and digital circuits, laser diodes and opto electronics! **$19.95**

UNCLE WAYNE'S CODE TAPES

We've had so many phone calls from people wanting our famous 73 code tapes that we've decided to bring them back!

Genesis **$5.95**

5 wpm–This is the beginning tape, taking you through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

The Stickler **$5.95**

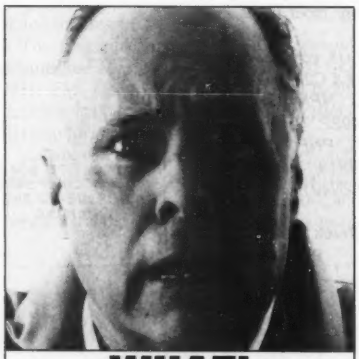
6+ wpm–This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five–definitely not memorizable!

Back Breaker **$5.95**

13+ wpm–Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

Courageous **$5.95**

20+ wpm–Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the Extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run; you'll wonder why the examiner is sending so slowly!



WHAT!

An OM of yours borrowed a prized copy of *73*, and now it's among the missing. Let Uncle Wayne help restock the issues in your almost complete *73* yearly volumes from July 1980 to the present.

Write us today for the copies you need from July 1980 to the present only. Sorry, but we've sold out all but a few collector's copies prior to July 1980.

JULY 1980 to present...$4.00 each
including postage and handling

CB-TO-TEN

73 has led the way on CB-to-10 meter conversions. Take advantage of our offer to help you get on 10 meters before the sunspots peak again. It's easy and saves you money!

#	Title	Issue
1	Bandplan and Crystal Info	May 77
2	Conversion Data	May 77
3	Radio Shack TRC-47	Jul 77
4	E.F. Johnson Messenger 123A	Jul 77
5	Hy-Gain 670B	Jul 77
6	Antenna Suggestions	Dec 77
7	Radio Shack Realistic TRC-II	Dec 77
8	The Publicom I	Feb 78
9	How about SSB Conversions?	Jul 78
10	Radio Shack TRC-11 and TRC-74	Aug 78
11	Radio Shack Realistic Mini 23	Sep 78
12	Hy-Range 681A (Hy-Gain)	Sep 78
13	Kraco KCB-2310B	Oct 78
14	Lafayette Telsat SSB-75	Nov 78
15	Radio Shack Realistic TRC-452	Nov 78
16	CB Walkie-Talkie Conversion	Nov 78
17	Sharp Model CB-800A	Jan 79
18	SBE Sidebander III and Pace 123A	Jan 79
19	Midland 13-882C and Other PLL Rigs	May 79
20	Lafayette SSB-75 and SSB-100	Jun 79
21	Royce I-655	Nov 79
22	Johnson Viking 352	Nov 79
23	CB to 10 FM - Part I	Jan 80
24	CB to 10 FM - Part II	Feb 80
25	More Talk Power for the TRC-11	Mar 80
26	Sears RoadTalker 40	Mar 80
27	Penney's SSB Rig	Apr 80
28	The Poly-Paks 40-Channel CB Board	Jun 80
29	The Cobra 132	Jul 80
30	New Life for SSB CB Rigs	Jul 80
31	Double Your Channels in SSB Conversions	Jul 80
32	On Ten FM	Aug 80
33	Put That Hy-Gain CB Board to Use	Sep 80
34	Peaking and Tweaking Hy-Gain Boards	Mar 82
35	CB to CW? (Hy-Gain)	Jul 82
36	Maximum Modulation for CB Conversions	Dec 82
37	Beef Up Your CB-to-CW Conversion	Feb 83
38	Add a Digital Readout to Your CB Conversion	Feb 83

Send $3.00 for the first article and $1.50 each thereafter. Just choose the article numbers and call with a credit card number or send a check or money order to: *CB to Ten, 73 Amateur Radio Magazine, WGE Center, Peterborough NH 03458 (603-525-4201).*

UNCLE WAYNE'S BOOKSHELF

•First Book of Modern Electronics Fun Projects *Edited by Art Salsberg*
Looking for a way to have fun, increase your technical expertise, and save money - all at the same time? This unique compendium chock-full of projects will show you how. **$19.95**

•Commodore 64 Troubleshooting & Repair Guide *by Robert C. Brenner*
This book will guide you step by step through the complexities of making simple repairs to your Commodore 64. **$19.95**

•C64/128 Programs for Amateur Radio & Electronics *by Joseph J. Carr*
The electronics hobbyist, programmer, engineer and technician will enjoy the task-oriented programs for amateur radio and electronics in this book. **$14.95**

•Fun Way Into Electronics *by Dick Smith*
This 3 volume series features introductory projects for beginning electronics enthusiasts. **$9.95 ea.**
•Vol 1 includes 20 projects on basic materials and tools, component discriptions and a guide to successful projects.
•Vol 2 gives 20 projects covering topics such as soldering onto circuit boards, using multimeters and reading circuit diagrams.
•Vol 3 covers advanced projects investigating integrated circuits, constructing PC boards and building a mini synthesizer.

•Basic Electricity/Electronics *by Robert R. Manville*
In this basic electricity/electronics series of textbooks a modern programmed format is used to present the material in a logical and easy-to-understand way. **$11.95 ea**
•Vol 1 introduces the student to the basic concepts of circuit fundamentals.
•Vol 2 (How AC/DC Circuits Work) This volume builds on the basics. It gives detailed information on series and parallel circuits; effects on inductance, capacitance and transformer action.

•Solid-State Projects You Build *by Rudolf F. Graf/George J. Whalen*
Have you searched for challenging innovative projects, imaginatively designed and skillfully debugged to stimulate your own creative thinking? If so, this book was written for you! **$10.95**

•The 555 Timer Applications Sourcebook with Experiments *by Howard M. Berlin*
This book is about the 555 timer. It will show you how to use it by itself and with other solid state devices. **$9.95**

•IC Users Casebook *by Joseph J. Carr*
This book was written for electronics hobbyists to provide insight into how practical ICs work in actual circuits. **$12.95**

•178 IC Designs & Applications *by Robert Mendelson*
Most integrated circuits used in the design of electronic devices are linear ICs. This book provides a complete understanding of these circuits. **$12.95**

•Weather Satellite Handbook *by Dr. Ralph E. Taggart*
Dr. Taggart has written this book to serve both experienced amateur satellite enthusiast and the new comer. Amateur weather satellite activity represents a unique blend of interests encompassing electronics, meterology and astronautics. **$16.95**

•One Evening Electronics Projects *by Calvin R. Graf and Richard S. Goss*
16 projects that can be assembled in a simple home workshop, a voltage detector, solid-state telephone bell, a transistor audio amplifier, and 13 others. This is an easy to understand, enjoyable guide to completing basic electronics projects - with just one evening's work. **$8.75**

•The Basic Guide to VHF/UHF Ham Radio *by Edward M. Noll*
This book provides a first rate introduction to life on the 2.6 and 1.25 meter bands as well as 23, 33, and 70CM. **$6.95**

•Crash Course in Electronics Technology *by Louis E. Frenzel, Jr.*
With a proven format of programmed instruction, this book teaches you the basics of electricity and electronics in a step-by-step, easy-to-understand fashion. **$21.95**

•Shortwave Radio Listening with the Experts *by Gerry L. Dexter*
Do you sit for long hours in front of a radio receiver listening to faint sounds and noises? Then you're a SWL'er or DX'er, and you can probably use some help. **$22.95**

•Mastering Packet Radio: The Hands-on Guide *by Dave Ingram K4TWJ*
Packet radio is the hottest, most rapidly expanding area of amateur communications. Written for the amateur enthusiast, mastering Packet Radio will put you on the cutting edge of this digital communications revolution **$12.95**

•ABC's of Electronics *by Earl Jacob Waters*
Written for anyone wanting to learn the basics of electroncs, this is a comprehensive, well illustrated look at the fundamentals of electronics and electronic applications. **$12.95**

THE WORLD
Is Yours For Only
$4.00

Yes, places you've never even heard of! Nearly 400 DX countries gleaned from the Awards Lists of dozens of IARU members—more countries than any other map available anywhere! ARRL's DXCC map doesn't even come close!

Uncle Wayne's Bookshelf Order Form

- ☐ The Packet Radio Handbook $14.95
- ☐ The Beginner's Handbook of Amateur Radio $16.95
- ☐ DX Power: Effective Techniques for Radio Amateurs $10.00
- ☐ Transmitter Hunting: Radio Direction Finding Simplified $17.95
- ☐ The Digital Novice ..... $ 9.95
- ☐ The Commodore Ham's Companion .... $ 9.95
- ☐ Master Handbook of 1001 Circuits $19.95
- ☐ World Press Services Frequencies (RTTY) ..... $ 8.95
- ☐ RTTY Today ..... $ 8.95
- ☐ Shortwave Clandestine Confidential .... $ 8.95
- ☐ Shortwave Directory $17.95
- ☐ The Hidden Signals on Satellite TV $19.95
- ☐ GGTE Morse Tutor floppy disk $20.00
- ☐ Radio Handbook $29.95
- ☐ Basic AC Circuits $24.95
- ☐ Easy-Up Antennas for Radio Listeners & Hams $16.95
- ☐ First Book of Modern Electronics Fun Projects $12.95
- ☐ Commodore 64 Troubleshooting & Repair Guide $19.95
- ☐ C64/128 Programs For Amateur Radio .. $14.95
- ☐ Fun Way Into Electronics Vol. 1 ..... $ 9.95
- ☐ Fun Way Into Electronics Vol. 3 ..... $ 9.95
- ☐ Basic Electricity & Electronics - Vol. 1 .. $11.95
- ☐ Basic Electricity & Electronics - Vol. 2 .. $11.95
- ☐ Solid State Projects You Can Build $10.95
- ☐ 555 Timer Applications Sourcebook .... $ 9.95
- ☐ 178 IC Designs & Applications $12.95
- ☐ Forest Mims' Circuit Scrapbook II $19.95
- ☐ Crash Course in Electronics Technology $21.95
- ☐ Shortwave Radio Listening with the Experts $22.95
- ☐ Mastering Packet Radio $12.95
- ☐ ABC's of Electronics $12.95
- ☐ Magic of Ham Radio ..... $ 3.95
- ☐ 1989 Passport to Ham Radio $14.95
- ☐ Genesis Code Tape ..... $ 5.95
- ☐ Stickler Code Tape ..... $ 5.95
- ☐ Back Breaker Code Tape ..... $ 5.95
- ☐ Courageous Code Tape ..... $ 5.95
- ☐ DX World Map ..... $ 4.00
- ☐ Weather Satellite Handbook $16.95
- ☐ One Evening Electronics Projects ..... $ 8.75
- ☐ The Basic Guide to VHF/UHF Ham Radio $ 6.95

You may order by mail, telephone, or fax. All payments are to be in U.S. funds. Please add $2.50 for shipping and handling for all orders except "CB to 10" and Back issues of *73 Magazine*. Allow 3 weeks for delivery.

Name _____

Street _____

City _____ State _____ Zip _____

TOTAL $ _____ ☐AE ☐MC ☐VISA ☐Check/Money Order

Card # _____ Expiration Date _____

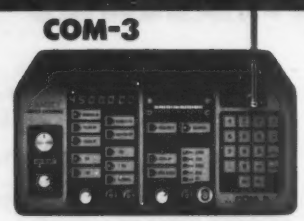
Telephone: (603) 525-4201, FAX: (603) 525-4423
Mail: *73 Magazine*, Att. Uncle Wayne, Forest Road, Hancock, NH 03449

73 AMATEUR RADIO
Forest Road,
Hancock, NH 03449

RAMSEY ELECTRONICS

Quality Test Gear & Electronic Kits for Professionals and Hobbyists

COM-3



$2495.00 THE COMMUNICATIONS SERVICE MONITOR THAT WORKS HARDER FOR LESS.

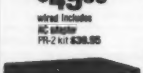
Introducing COM-3…the new service monitor designed by service technicians for service technicians. It works harder for less…giving you advanced testing capabilities at a very affordable price.

FEATURES • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10,000 μv output levels • High receive sensitivity, less than 5 μv • 100 KHz to 999.9995 MHz Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder, 1 KHz and external modulation

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp • 3 db NF

$49.95 wired. Includes AC adapter. PR-2 kit $39.95



PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiples Up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$69.95 wired. PS-2 kit $49.95

PS-10B 1.5 GHz PRESCALER

Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

$89.95 wired includes AC adapter

FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

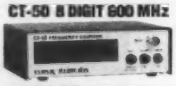
CT-70 7 DIGIT 525 MHz

$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz

$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz



$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz

$189.95 WIRED INCLUDES AC ADAPTER

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz < 100mv To 450 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MINI KITS—EASY TO ASSEMBLE—FUN TO USE

TONE DECODER
A complete tone decoder on a single PC board. Features 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 **$5.95**

40 WATT 2 mtr PWR AMP
Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, less case and T-R relay.
PA-1, 40 W pwr amp kit **$27.95**
TR-1, RF sensed T-R relay kit **6.95**

COLOR ORGAN
See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W runs on 110VAC.
ML-1 Kit. **$8.95**

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9 VDC.
VS-1 KIT **$6.95**

VIDEO MODULATOR
Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

LED BLINKY KIT
Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.
BL-1 Kit, **$2.95**

MAD BLASTER
Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC
MB-1 Kit **$4.95**

UNIVERSAL TIMER
Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.
UT-5 Kit **$5.95**

WHISPER LIGHT
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.
WL-1 Kit **$6.95**

FM WIRELESS MIKE
Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.
FM-1 Kit **$3.95**
FM-2 Kit **$4.95**

SIREN
Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 **$2.95**

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
BN-9 Kit **$5.95**

60 Hz TIME BASE
Runs on 5-15 VDC. Low current (25ma) 1 min/month accuracy
TB-6 Kit **$5.50**
TB-6 Assy **$9.95**

TELEPHONE TRANSMITTER
Low cost with professional performance. Features include; self phone line powered, tunable from 76 to 100 MHz, polarity antisensitive, compact size (1½" x 1¼"), easily installs anywhere on the phone line or inside the instrument itself.
PB-1 KIT **$14.95**

FM RECEIVER
For built-in applications or hobby experimentation. Full fledged superheterodyne receiver, microvolt sensitivity. 10.7 MHz IF. Integrated Circuit detector. 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception
FR-1 KIT **$14.95**

FM MINI MIKE
A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super sensitive receiver. This is the finest unit available.
FM-3 Kit **$14.95**
FM-3 Wired and Tested **19.95**

NEW

MICROWAVE INTRUSION ALARM
A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.
Complete Kit, MD-3 **$16.95**

NEW

SPEECH SCRAMBLER
Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC D6M circuitry. Can also be used to descramble most com. scramblers.
Complete kit, SS-7 **$29.95**
Case kit, CSS-7 **12.95**

ALL NEW KITS

SPEEDY

Complete kit, SG-7 **$89.95**

PERSONAL SPEED RADAR

New low cost microwave doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners or virtually anything that moves. Operates at 2.6 GHz with over 1/4 mile range. LED digital readout displays speeds in miles per hour, kilometers per hour or feet per second! Earphone output permits listening to actual doppler shift. Uses two 1 lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

RADIOS

40 & 80 METERS HAM RECEIVERS

Sensitive all mode, AM, CW, SSB receivers for 3.5—4.0 or 7.0—7.5 MHz. Direct conversion design using NE602 IC as featured in QST and ARRL handbooks. Less than 1 μv sensitivity, varactor diode tuned, 50 mw audio output. Runs on 9VDC, has RF gain control. This kit is very easy to build, lots of fun and educational—ideal for the beginner or the old pro. The optional matching case kit features a rugged ABS plastic case with screened graphics. Included are machined aluminum knobs for a well-finished professional look.

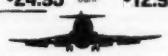
40 Meter receiver kit, HR-4 **$24.95** | 80 Meter receiver kit, HR-8 **$24.95** | Receiver case kit, CHR **$12.95**

QRP TRANSMITTER KITS, 40 & 80 METERS

Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

40 meters QRP rig, QRP-40 **$24.95** | 80 meters QRP rig, QRP-80 **$24.95** | Case kit, CQRP **$12.95**

AIRCRAFT RECEIVER KIT



Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1 **$24.95** | Receiver case kit, CAR-1 **$12.95**

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

Complete kit, SR-1 **$24.95** | Receiver case kit, CSR-1 **$12.95**

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software, PC board, all necessary parts and full documentation.

Complete kit, PC-1 **$49.95**

FM COMMUNICATIONS/2 METER RECEIVER

Sensitive superhet FM receiver tunes any 5 MHz segment from 135—175 MHz. Listen to 2 mtr ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

Complete kit, FR-7 **$29.95** | Receiver case kit, CFR-7 **$12.95**

NEW MINIKITS—NEW MINIKITS

BROADBAND PREAMP

A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.

Complete kit, SA-7 **$12.95**

LIGHT BEAM COMMUNICATORS

Transmits modulated infrared light up to 30 feet without lenses up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

Transmitter kit, LB-6 **$8.95**
Receiver kit, LB-5 **$9.95**

HIGH POWER FM WIRELESS MIKE

A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC

FM-4 kit **$9.95**
Sensitive microphone cartridge **$2.95**

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output allowing you to hit the repeaters full quieting while the low noise preamp remarkably improves receptions. Ramsey Electronics has sold thousands of 2 mtr amp kits but now, we offer completely wired and tested 2 mtr as well 220 MHz units. Both have all the features of the high priced boosters at a fraction of the cost.

- 30 WATTS OUTPUT
- LOW NOISE PREAMP
- LOW COST
- RUGGED CAST ALUMINUM CASE
- ONE YEAR WARRANTY

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $59.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested..... $59.95

MasterCard VISA

TERMS • satisfaction guaranteed • examine for 10 days if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • foreign add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $20.00 add $1.00 • NY residents add 7% sales tax • 90 days parts warranty on all kits • 1 year parts & labor warranty on all wired units.

PHONE ORDERS CALL
716-586-3950
FAX 716-586-4754

RAMSEY ELECTRONICS, INC., 2575 Baird Rd., Penfield, N.Y. 14526

CIRCLE 34 ON READER SERVICE CARD

CW Transceiver for 20 Meters

Get on this favorite DX band.

by Frank Lee G3YCC

Adapted from G-QRP Club Circuit Handbook

Are you ready for the challenge of 20m QRP? Want the added enjoyment of rolling your own rig? If so on both counts, then check out the following home-brew project! This interesting little project uses components ranging from tubes to ICs.

Hybrid

Some of the modules used to build this rig were removed from existing equipment; others were built specially. This explains the different devices for the TX modulator and the RX mixer, the option of two carrier injection oscillators (CIO), and the SSB-type filter instead of a CW filter.

Circuit Description

The Colpitts VFO circuit, Figure 1, has gate clamping to improve stability. It's followed by two buffers, the second providing individual outputs to the TX and RX. A RIT circuit operates on receive. You must set it up correctly when you first align the rig (see instructions below).

Build the VFO in a stout metal box, with care for mechanical rigidity. The RX front end uses 40673 dual-gate MOSFETs (see Figure 2). The tuned circuits are peaked to the center of the CW band with trimmers.

Coil winding details for the VFO and other stages appear in the respective figures.

The mixer output is link-coupled to a KVG 9 MHz SSB filter, whose output is amplified by an SL612 IF amplifier IC (see Figure 3). The product detector uses two BC 107 transistors. Carrier reinjection is from a crystal oscillator using the USB crystal supplied with the KVG filter. Figure 4 contains two diagrams: an FET oscillator and a PNP bipolar oscillator. You can use either, or you can alter the circuit polarities to suit an NPN transistor. An LM380 IC would work fine here.

The TX mixer is an MD108 (Figure 5), fed from the VFO and the lower sideband carrier injection oscillator. (You could probably use the less expensive 40673 as a mixer.) The mixer output is applied to an SL610C RF amplifier, then to a FET which drives a 12BY7A PA similar to that in the well-known "Tucker Tin" circuit. I tried to use a transistor PA, but had troubles with it (likely due to my lack of experience in transistor PA design!).

A simple diode/meter circuit measures relative power output (see Figure 6). Sidetone is provided by an NE555 circuit (see Figure 7).

Send/receive switching is by means of a 4-pole change-over relay controlled from a

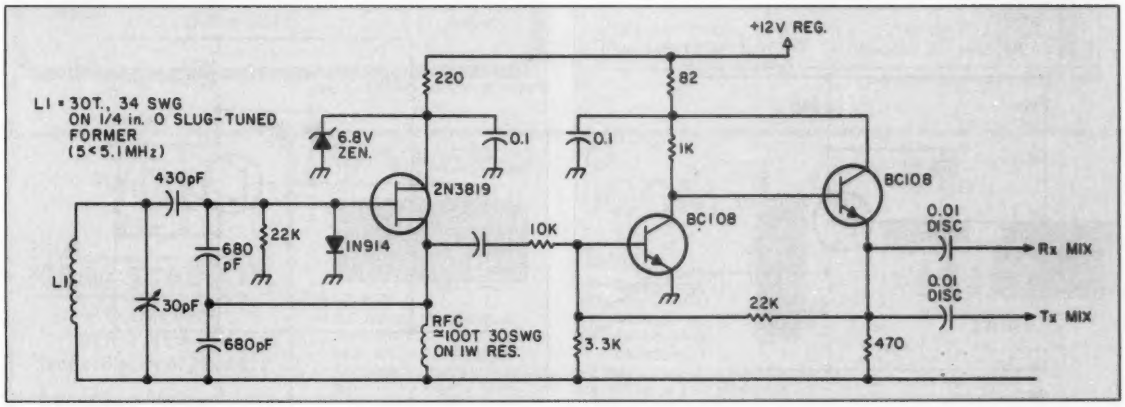


Figure 1. Colpitts VFO circuit.

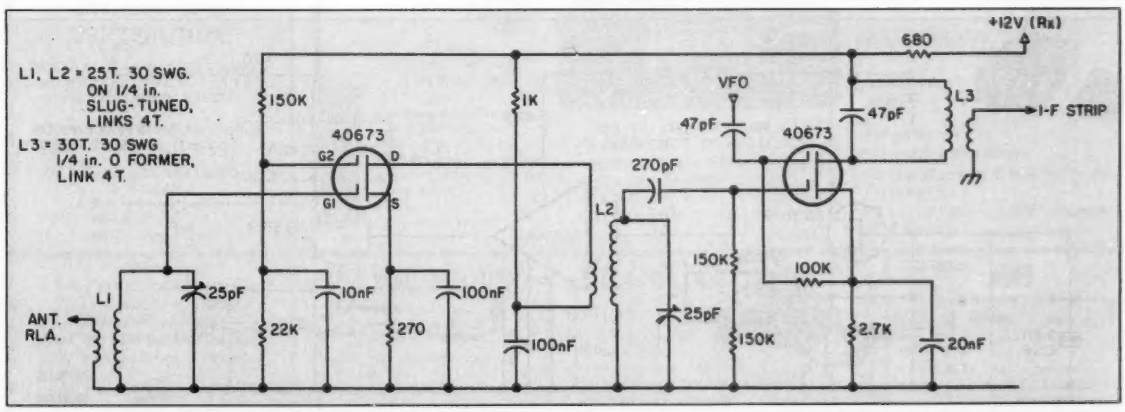


Figure 2. The receive front-end. The associated tuned circuits are peaked to the center of the CW band with trimmers.

switch, with one spare contact set. A reed relay is used for keying. You could also operate this rig on 80 meters after selecting the appropriate VFO and CIO frequencies and changing the appropriate coils.

RIT Alignment

Alignment is conventional except for the RIT (Figure 8), which must be set up as follows to compensate for the frequency difference between the two CIO crystals:

1. Using an external receiver with no aerial connected, and a signal source such as a crystal calibrator, switch the transceiver to "send" and zero beat it with the signal source.

2. Switch the transceiver to receive, then use the RIT control to zero beat it with the signal source. Carefully mark the setting of the RIT control on the front panel of the transceiver so that it can be accurately repeated.

3. When searching the band, do so with the RIT control set to this mark. If it is required to net on to another station, tune to zero beat, then off-set the RIT control to give the required beat note. After a QSO or an unsuccessful call, always reset the RIT control to its zero mark in readiness to zero beat with the next station to be called.

So what's the best DX so far with this rig? A VK answered a CQ from G3YCC—you can't get too much further than that!

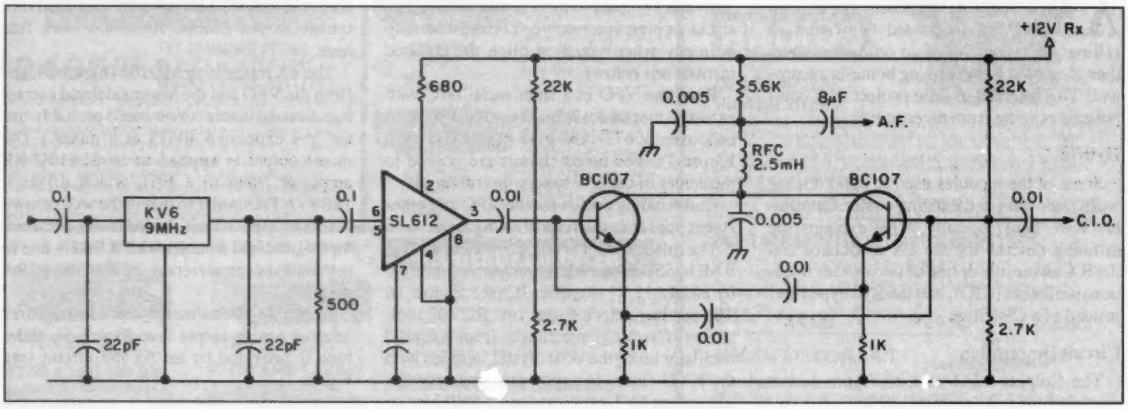
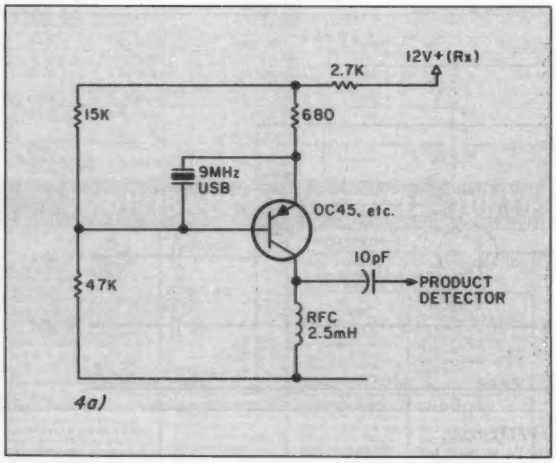


Figure 3. Receive filter, IF, and product detector.



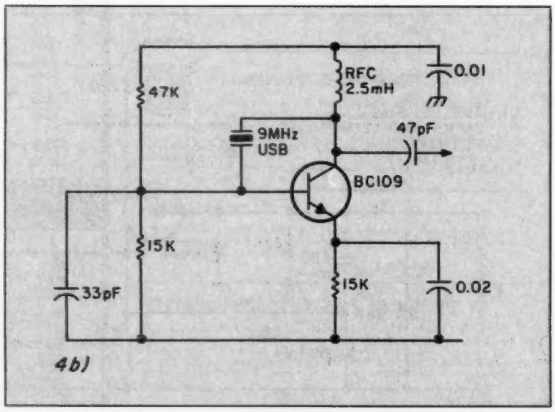


Figure 4a,b. What's in the junk-box? Pick between two receive carrier circuits.

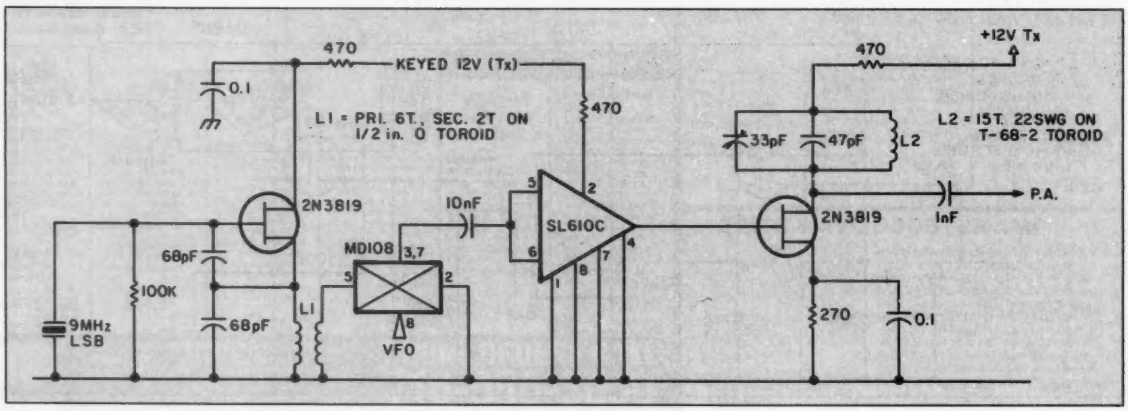


Figure 5. Transmit mixer and predriver.

T.V.I. problems?

Low pass T.V.I. filters from Barker & Williamson

FL10/1500 FL6/1500 FL10/100 FL6/100

Model	Power (Watts)	Cut Off Frequency	Frequency of Maximum Attenuation	Minimum Attenuation	Frequency Range	Price
FL10/1500	1000	34 MHz	52 MHz	70 db	1.8 - 30 MHz	$36.95*
FL10/100	100	44 MHz	57 MHz	60 db	1.8 - 30 MHz	$29.50*
FL6/1500	1000	55 MHz	63 MHz	70 db	6 meter	$49.50*
FL6/100	100	55 MHz	63 MHz	50 db	6 meter	$34.50*

All above to match 50 ohm transmitters and antennas.

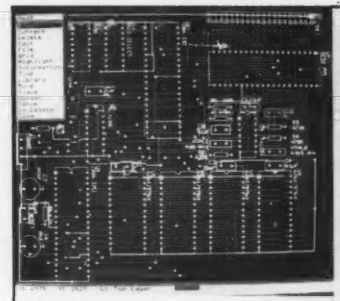
*Add $2 shipping and handling.

ALL OUR PRODUCTS MADE IN USA

BARKER & WILLIAMSON

Quality Communication Products Since 1932
At your Distributors. Write or Call
10 Canal Street, Bristol PA 19007
(215) 788-5581

CIRCLE 53 ON READER SERVICE CARD



EASY LOW-COST PCB DESIGN

PROTEL-EASYTRAX ~~$495~~ **INTRO PRICE $395**

Easy to learn, easy to use manual PCB design package. Capable of producing professional artwork for multi-layer, through-hole boards to 32 x 32 inches. Host of powerful editing features make efficient PCB lay-out a breeze. Gerber and NC Drill output.

Protel offers other fine programs: PROTEL-SCHEMATIC, the easy to use schematic capture program, and PROTEL-AUTOTRAX, the full-featured PCB layout program.

HARDWARE: IBM PC/AT/XT/PS2 or compatibles..... 640K RAM..... 2 floppies or a hard disk..... PC or MS-DOS greater than version 2.0

ORDER TOLL FREE, CALL: (800) 544-4186
If you are in CA, HI, AK, or Canada, call: (408) 437-7771

PROTEL TECHNOLOGY INC.
A Member Company of Cntec Corporation

50 Airport Parkway
San Jose, CA 95110

(408) 437-7771
fax (408) 437-4913

CIRCLE 378 ON READER SERVICE CARD

the HAM STATION

P.O. Box 6522
220 N. Fulton Ave.
Evansville, IN 47719-0522

Store Hours
MON-FRI: 9AM - 6PM
SAT: 9AM - 3PM
CENTRAL TIME

SEND A SELF ADDRESSED STAMPED (50¢) ENVELOPE (SASE) FOR NEW AND USED EQUIPMENT SHEETS.

WARRANTY SERVICE CENTER FOR: ICOM, YAESU, TEN-TEC

FOR SERVICE INFORMATION CALL
(812) 422-0252
FAX 812-465-4449
MONDAY - FRIDAY
9:00 AM - 12:00 NOON

YAESU

FT-747GX
- 100 Watts of Economical Performance
- Dual VFO's, 20 Memories
- Receives from 100 kHz-30 MHz
- Built-in CW Filter + More

NEW!

FT-470
COMPACT 2M/70CM DUAL BAND FM
- Simultaneous Reception on Both Bands
- Up to 5 Watts Output
- 21 Memories on Each Band
- Built-in 10 Memory DTMF Auto Dialer
- Built-in CTCSS PLUS MORE!

ICOM

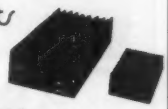
IC-32AT
- New Dual Band HT
- RX-138-174 MHz 440-450 MHz
- TX-140-150 MHz 440-450 MHz
- 5 Watts Output on Both Bands
- Full Duplex & 20 Memories

IC-228A
- 25 Watt, 2 Meter FM Mobile
- RCV 138-174 MHz
- TX 140-150 Mhz
- 20 Memories

TEN-TEC

OMNI V
- New U/LSB, QSK, CW, FSK HF Rig
- Dual VFO's, 100 W Output
- Allbands 160-10
- Superior "Phase Noise"
- Made in USA

concept



VHF/UHF AMPS
- High VSWR and Overdrive Protection
- 5 Year Warranty, 6 Months on RF Transistors
- All Units have GaAsFET Receive Pre-amps

TERMS:
Prices Do Not Include Shipping.
Price and Availability Subject to Change Without Notice
Most Orders Shipped The Same Day
COD's Welcome ($3.50 + shipping)

VISA Discover MasterCard

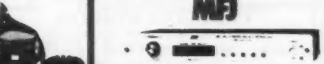
Kantronics

KAM
- Packet, WEFAX, ASCII, AMTOR, RTTY, CW
- Simultaneous Operation on HF and VHF

ALINCO

DR-110T
NEW 2 Meter Mobile
- 45 Watts Output
- 14 Memories with Standard Encode/Decode Subaudible Tones
- CAP and MARS Modifiable

MFJ



MFJ-1278
- Multi-Mode Data Controller
- Packet, RTTY, ASCII, CW, WEFAX, SSTV, Contest Memory Keyer

Orders and Price Checks Call 800-523-7731
Indiana and Information Call 1-812-422-0231

Please send all reader inquiries directly.

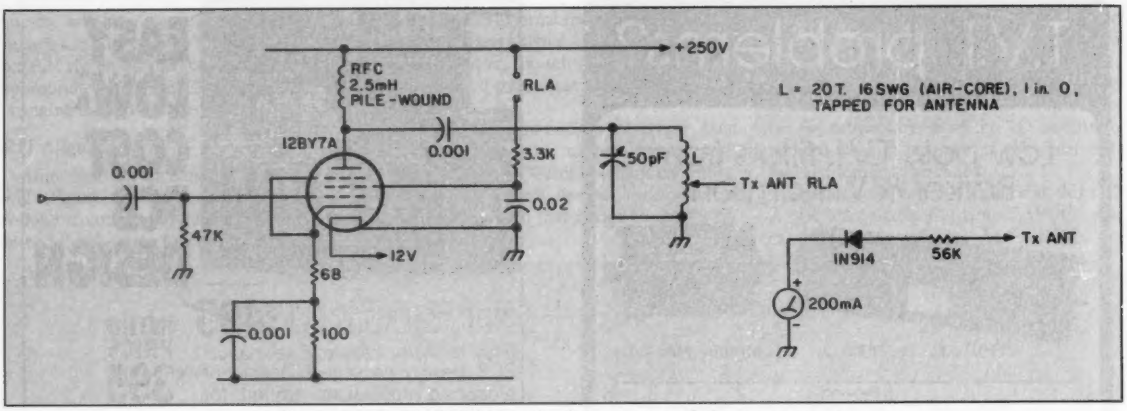


Figure 6. A simple diode/meter circuit to measure relative power output.

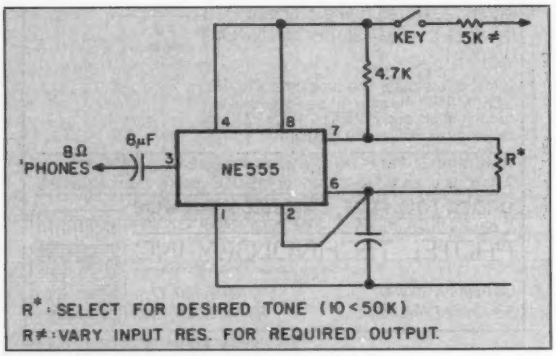


Figure 7. Sidetone circuit.

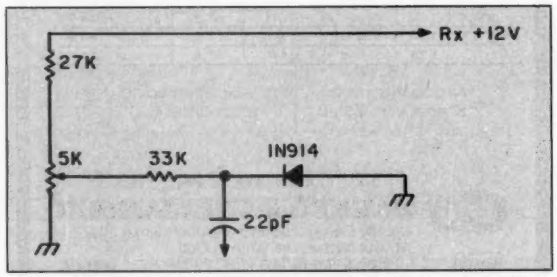


Figure 8. RIT circuit. Set RIT to compensate for the frequency difference between the two CIO crystals.

Where's the Beam?
Unobtrusive DX Gain Antennas for 80 thru 10
• Easily hidden • Install Fast • Fixed or Portable •

There's a 20 meter antenna with real DX Punch hidden in this picture. You can't see it, and your neighbors can't either. But it works DX barefoot anyway. How about a low profile 80/40/30 m-bander? Or a 2 element monobander for the attic? All easily fit the pocketbook--Priced $29 to $99.

Work DX without telling the neighbors

Infopack $1 Box 50062-R, Provo, UT 84605 *AntennasWest* (801) 373-8425

CIRCLE 5 ON READER SERVICE CARD

1989 CALL DIRECTORY
(On microfiche)
Call Directory $8
Name Index 8
Geographic Index 8
All three — $20
Shipping per order $3
BUCKMASTER PUBLISHING
Mineral, Virginia 23117
703: 894-5777 800: 282-5628

CIRCLE 7 ON READER SERVICE CARD

THIS MONTH'S GOODIE FROM THE CANDY STORE
RDC [redacted] KENWOOD TS-440S/WAT UNDER $1290.00 (JUNE ONLY)
SIMILAR SAVINGS ON KENWOOD, ICOM, YAESU, HY-GAIN, ETC. ALL L.T.O.
BENCHER BY-1 $52.90
OVER 8788 HAM RELATED ITEMS IN STOCK. ALL PRICES CASH FOB PRESTON
More specials in HAM-ADS.
LOOKING FOR SOMETHING NOT LISTED?? CALL, WRITE, or FAX
ROSS DISTRIBUTING COMPANY (P.O. Box 234)
78 South State Street, Preston, Idaho 83263
Telephone (208) 852-0830 FAX #(208) 852-0833
We close at 2:00 P.M. MONDAY & ALL DAY SATURDAY

CIRCLE 254 ON READER SERVICE CARD

Discover CAROLINA WINDOM

80–10M
Use transmatch
132' overall
Matching XFMR
Line Isolator
Vert Radiator
Coax fed
Assembled
$69.95

High performance
Proven Results
$70 Beam?

Your Passport To a world Of new ideas And exceptional HF wire antennas

The RADIO WORKS

Rugged new baluns
Full range of HF, VHF mobile antennas, ducks, wire, coax, parts, line, accessories.

SEE WHAT WE'RE DOING NOW!
Contact Jim, W4THU—free discount catalog
Send $1 for catalog by 1st Class mail.
Box 6159, Portsmouth, VA 23703
(Dealer Inquiries Welcome)
804-484-0140

CAROLINA WINDOM
SEE THE REVIEW IN DECEMBER '88 73 MAGAZINE
Enthusiastic users say it's the best wire antenna. Outperforms wire antennas previously used. Knock-you-socks-off performance on 80-10. A $70 beam?
If you hear one, you'll want one.
Made with pride by the RADIO WORKS in VA/USA

CIRCLE 150 ON READER SERVICE CARD

Wideband Preamp 10-1000 Mhz

Dual GasFet low noise preamplifier for HF, UHF or VHF systems. Just perfect for the R-7000. Excellent for Spec Analyzers, Scanners, etc. Gain 20 Db +/- 1 DB, -3 Db at 2 & 1100 Mhz. 1 Db compression of >10 Dbm. Intercept points >45 Dbm. New shipped price of only $124.95. Pa. residents please add 6% state tax.

GTI Electronics
RD 1 BOX 272
Lehighton, Pa. 18235
717-386-4032

CIRCLE 326 ON READER SERVICE CARD

★ OMAR ELECTRONICS ★
FOR ALL YOUR AMATEUR NEEDS
SPECIAL PRICES on all
MFJ PRODUCTS ★ A.R.R.L. PUBLICATIONS
and other Ham Radio equipment!
VISA 404-760-8846
OMAR ELECTRONICS • Omar Pupo WA8FON
3650 HWY 138 NE Suite C • Loganville, Ga 30249

CIRCLE 292 ON READER SERVICE CARD

KENWOOD ICOM YAESU
We want to be Your Radio Store
Full Line of Amateur Radio and Computer Interfacing & Accessories. - Tim W7IDY of Preben K7KMZ
CPI Inc.
1-800-942-8873
(801) 467-8873
1057 E. 2100 So. Salt Lake City, Utah 84106

CIRCLE 343 ON READER SERVICE CARD

No gain.No pain.

Maintaining a moderate weight may reduce your risk of heart attack.

American Heart Association
WE'RE FIGHTING FOR YOUR LIFE

73 in 1988

How often have you asked yourself, "Where did I see an article/review on that rig?" Or wanted to locate a fabulous article but could remember only the name of the author and/or callsign?

Now you have an excellent resource—*73*'s compiled Index for 1988. This is a complete listing of all of our reviews, features, and columns, and a complete keyword listing for every issue from January through December 1988.

The index is available in a printed format, on an MS-DOS 5¼" floppy disk (ASCII format), or by direct upload (have your credit card number ready). The hard-copy is two dollars, and the floppy costs five. Uploading costs five dollars at 1200 baud, and $7.50 at 300 baud. Send your check or money order, along with your name and address, to:

1988 Index
73 Magazine
WGE Center, 70 Route 202N
Peterborough, NH 03458-1194

RAISED PRINT QSL CARDS

From Dennis, WA5QMM

Offset Printed - High Quality

Nothing like it anywhere! You can actually FEEL the type! 17 beautiful designs including a Full-Color Eagle.

For Free samples & Info. call

(318) 443-7261

Network QSL's - P.O.B. 13200 - Alexandria, LA 71315-3200

CIRCLE 114 ON READER SERVICE CARD

DEALERS

Sell *73 Amateur Radio*

Selling *73 Amateur Radio* will make money for you. Consider the facts:

- If you carry *73 Amateur* Radio it will increase your store traffic—and our dealers tell us that *73* is the hottest selling amateur radio magazine on the newsstand today.
- Increased store traffic means increased sales for you. Hams will come into your store to pick up the latest issue of *73* and end up buying the latest all-band, all-mode transceiver (or at least a few feet of coax).
- *73 Amateur Radio* guarantees each issue—you pay only for the copies you sell. We pay for all shipping.

For information on selling 73 Amateur Radio, *call Peter Murphy at 800-722-7790, or write to* 73 Amateur Radio, *WGE Center, Forest Road, Hancock, NH 03449.*

73 AMATEUR RADIO

LOGWRITE™

Are you tired of wasting your time and money on sub-par logging programs? Bring your station into the computer age with **LOGWRITE**, the quality menu driven, user friendly logging program written by Ed Troy (NG3V). **LOGWRITE** is the perfect accessory for the complete ham station. It simplifies your operation and gives you the competitive edge in contesting and DXing. **LOGWRITE** works with all IBM PCs and compatibles.

LOGWRITE's unique split screen feature allows for simultaneous logging and text processing. Logging features include:

- -Instant callsign or prefix search
- -Print, Edit, or View records
- -Plenty of room for notes & addresses
- -Automatic time/date stamping

Text processor features automatic word wrap, backspace correct, and scrolling. Throw away your pen and paper!

To order your copy of **LOGWRITE**, complete with instruction manual, send $24.95 (Pa. residents add $1.50 sales tax) to:

Aerospace Consulting
P.O. Box 536, Buckingham, PA 18912
(215) 345-7184
30 day money-back guarantee

Or call 1 (800) 345-4156 ext. 54 to order with Visa/ Mastercard (Please specify 3.5 or 5.25 inch floppy.)

CIRCLE 88 ON READER SERVICE CARD

ART-1: A complete interface system for send and receive on CW, RTTY (Baudot & ASCII) and AMTOR, for use with the Commodore 64/128 computer. Operating program on disk included. **$199.00**

AIR-1: A complete interface system for send and receive on CW, RTTY (Baudot & ASCII) and AMTOR, for use with Commodore VIC-20. Operating program in ROM. **$99.95**

SWL: A receive only cartridge for CW, RTTY (Baudot & ASCII) for use with Commodore 64/128. Operating program in ROM. **$64.00**

AIRDISK: An AIR-1 type operating program for use with your interface hardware. Both VIC-20 and C64/128 programs on one disk. **$39.95**

AIR-ROM: Cartridge version of AIRDISK for C64/128 only. **$59.95**

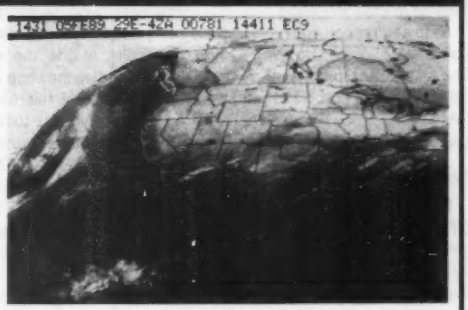
MORSE COACH: A complete teaching and testing program for learning the Morse code in a cartridge.
For C64 or C128. **$49.95**
VEC SPECIAL **$39.95**

G AND G ELECTRONICS
OF MARYLAND

8524 DAKOTA DRIVE, GAITHERSBURG, MD 20877
(301) 258-7373

CIRCLE 372 ON READER SERVICE CARD

PC HF FACSIMILE 4.0 $99



Actual VGA Screen Photo

The best computer FAX system just got better!

A complete facsimile reception system for the IBM PC or Compatible. Receives up to 16 intensity levels.

Includes:
- **Demodulator**
- **Software**
- **Frequency List**
- **80 Page Manual**
- **Tutorial Cassette**
- **Interpretation Guide**

Features:
- **Print on Epson, or HP Laser Jet**
- **Disk Save, Zooming, Image processing**
- **Unattended Image Capture and much more**

Software Systems Consulting
1303 S. Ola Vista, San Clemente, CA. 92672
(714)—498—5784

CIRCLE 250 ON READER SERVICE CARD

ABOVE AND BEYOND

VHF and UHF Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

10 GHz ARRL Contest Preparations

In April, I covered the construction of a tripod and microwave dish antenna for use on 10 GHz. This month I would like to continue with local involvement and where to get equipment to operate on the microwave bands. The prime goal is to prepare for the 10 GHz ARRL contest later this summer. This month, let's cover some of the things that you can do in your own area to enhance operation on microwave.

At first I thought San Diego was dormant until N6IZW and I started to talk about operations on the local repeater and at swap meets. This resulted in quite a few fellow amateurs forming a common interest forum, the San Diego Microwave Group. Through discussions, we began forming a common bond, which has grown and spread quite widely. Participation in a local group stimulates interest and helps us sort out data from other parts of the country. This assists us in experimenting.

As to equipment, you have basically two choices: buy the very fine M/A COM Gunnplexer, or obtain surplus microwave equipment at swap meets or even possibly for free.

Scrounging for Equipment

By scrounging, you can get QRV on the 10 GHz microwave band for next to nothing. The quality is not as good as the M/A COM Gunnplexers, but it will work well. Go to your local burglar alarm and electric door companies and try to obtain some of the older microwave control units they no longer use, since they're switching to I.R. optical units.

Pat AA6EG wrote to me questioning the use of a peculiar type of alarm unit and detector diode current. See Figure 1 for details. You can check the detector for injection with a meter (0 to 1 mA) in series with the detector diode and ground. With the transmit source on, you should observe a DC current flowing in the detector. About 0.5 to 0.7 mA is optimum. Adjust the frequency of the transmit source to the ham band, usually about 10.250 GHz, by lowering the frequency adjust screw further into the cavity about 1 to 2 turns. The microwave unit is set in the factory to around 10.525 GHz.

The only limiting factors with surplus devices are the system sensitivity and any gains associated with detector noise and antenna types. Remember the SOLFAN types were intended to be short range devices, but they work very well for the small cost of obtaining them.

Transmitter output power is a consideration, but you may be surprised with what you can do with 10 mW. Usually, with modest transceivers and small horns, 25 miles is the limit. With larger dish antennas, 200-mile contacts are possible.

By the way, I still have a quantity of 50 to 100 mW 10 GHz Gunn devices available for $5 each postpaid.

Success Stories

Steve KA0ZIL from Plymouth, Minnesota, writes: "I had some time off from work, so I called some local automatic door companies. I picked two out of the several listed because they were local companies. I struck paydirt with both calls. At one, the tech is going to clean up the shop next week and set aside all microwave units he would otherwise toss out. The other shop had two units for me! One was an old SOLFAN with a detector, and the other was a small black box, like the ones above the doors at the grocery store. The kicker is that they both work!"

Steve KA0ZIL goes on to say that with two units, he will probably rope Rusty N0HVW, a good friend, into 10 GHz operation. Figure 2 is a sketch Steve provided of one of his units. This unit is very similar to the SOLFAN devices. Power to the Gunn diode is positive.

With 5 volts positive on the Gunn, Steve was able to measure about 1 mA on the detector diode. A little much, but still OK for a transceiver. Connecting the detector to a monitor receiver, Pat was able to detect his finger movement in front of the cavity while monitoring on the receiver. For a Doppler radar device, connect your detector diode to a small audio amplifier. The low frequency sound you hear is the microwave Doppler signals returning. As a matter of fact, the radar devices the police use are very similar. They have circuits that measure only the low frequency audio tone (Doppler) to indicate your speed. It's a direct correlation. For a speed of about 35 miles per hour, the audio Doppler returned is about 1085 Hertz. This works out to about 31 Hertz per mile per hour.

Setting the Frequency

The biggest problem remaining is to set the frequency so that your operation is within our amateur bands. I have received letters from several amateurs without test equipment, who are trying to set the frequency. Without test equipment, it can be quite bothersome. I am willing to set up cavities sent to me in the mail (provided return postage is included) to the frequency desired, and I will provide a voltage vs. frequency spread calibration chart for the unit. Ron Wicker WA5VJS has taken me up on this offer and shipped me two SOLFAN units.

I set both units on 10.250 GHz with my HP counter. It remains to be seen just how much bouncing around the units will take for a change in frequency in the postal system. They were well-packed and should survive. Postage cost less than I'd anticipated, at $2 for a one-pound package. The rates go up very quickly for a package over two pounds.

The Injector, described in the January 1989 issue of *73 Magazine*, is an alternative to verifying frequency. Take a detector mount and replace the normal detector (1N23 diode) with a surplus varactor and a 3 dB pad for DC return. Inject your 2 meter HT on low power (100 mW) in to the mount. The varactor should produce energy radiating on 10 GHz. 146 MHz times the 70th harmonic = 10.220 GHz, a good marker. Experiment with surplus varactors for best results on output. It will be very low power, and close coupling is needed, but it works well.

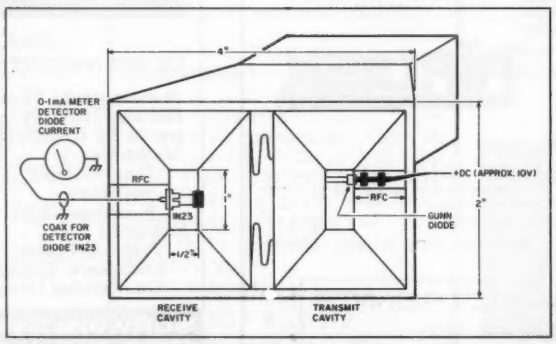


Figure 1. 10 GHz dual cavity from AA6EG. Each cavity couples to its own horn antenna. Antenna gain is 10–12 dB.

So. Cal. Microwave Weekend News

There was quite a flurry of microwave activity on 10 GHz narrow band FM and SSB here in southern California over our most recent microwave weekend. The contacts were from a location in the Lake Arrowhead, San Bernardino mountains at Heaps Peak. Phil W6HCC was operating his 10 GHz system with about 1 Watt of power output, and had a very noticeable signal. You could turn your antenna some 20 degrees away from the true path and still copy him at a distance of over 100 miles with no trouble.

There were several other stations operating remote to Phil W6HCC at Heaps Peak. Chuck WA6EXV was operating in the desert to the east checking out locations. Kerry N6IZW, Ed W6OYJ, Art WA6OYS, and Leon WA5BNH from the San Diego Microwave Group were operating on Mt. Soledad in San Diego proper, anchoring the southern end of the 100 mile test path.

The signals from W6HCC's rig with 1 Watt output were so strong they were pinning the S-meter on the narrow band systems at Mt. Soledad, 153 km distant. Kerry N6IZW made contacts with both FM and SSB over the 10 GHz path to Heaps with relative ease. His system uses a two stage MGF-1402 preamp with about 18 dB gain and 4 dB noise figure. Provisions are made in N6IZW's rig to reverse the amplifier and use it in the transmit mode, as it is linear

and gets about +5 dBm output on transmit (approximately 3 mW power). The S-meter indicated full peg on both SSB and FM.

Leon WA5BNH was using his system which places the mixer directly on the antenna without a preamp. His output power (transmit) is about 100 µW. Leon was able to make contact with Phil W6HCC on Heaps Peak who was still full peg on WA5BNH's rig. W6HCC decided to reduce his power to about 100 mW, and Leon WA5BNH saw the S-meter come just off the peg. Further reducing W6HCC's power to 20 mW gave WA5BNH's S-meter an S-7. The copy at Heaps was just above marginal during the test, using 5 kHz FM for the contact on 2 meter HTs.

Kerry decided to try another test. He replaced the 2 meter FM transceiver with a Santec LS-202 multimode 2 meter HT capable of FM and SSB with the same transmitter power. He switched the mode to SSB on both ends of the path. The resulting copy went to full Q-5 copy on SSB at Phil W6HCC's location. Going back to FM again led to marginal copy. It's often very handy to be able to switch to SSB from FM to improve copy on a long path.

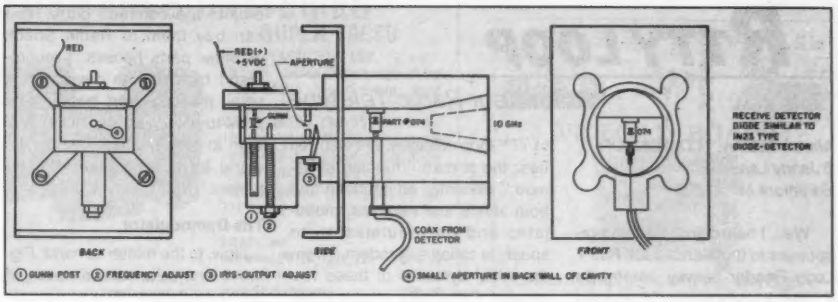


Figure 2. KAØZIL's 10 GHz unit. With 5 V to ground, the detector diode gives about 1 mA DC.

Equipment Detail

A brief outline of the equipment is in order so that you can see just what is pieced together. The parts are not all identical, and they depend on what is available through scrounging or swap meets. The heart of the unit is the phase-locked oscillator that provides about +10 to +20 dBm output on 10 GHz. The units that we have been able to obtain have come from many different sources. The prime source seems to be the surplus disposal section at Collins Microwave in Richardson, Texas. They hold monthly auctions to dispose of out-of-spec equipment, and the hams in that area pick up the material and make it available through newsletters and swap fests.

The phase-locked oscillator is basically a high power microwave oscillator running in the 1.2 to 2 GHz range, depending on the model. You tune it with a varactor controlled by a 97 to 100 MHz crystal reference. Some crystal oscillators are internal and some are external. The internal types usually demand a higher price, about $35 to $50 dollars each, depending on condition. The less desirable units run about 5 to 10 dollars less. In future columns I will describe fully the microwave "brick" oscillators as well as the preamps used, and the relay switching techniques needed to place a system of your own in use.

Let's Hear From You!

I would be glad to answer any questions concerning VHF/UHF and microwave operations. Please send a self-addressed stamped envelope for a prompt reply. I will include some of your letters in future columns to assist others who are having the same problem. Send all questions to me at the above address. 73s and see you next month! 73

Keyword Index

Number 22 on your Feedback card

Issue #345

10 GHz 70
10 meters 30, 82
13 cm 61
20 meters 65
30/40 meters 20
80 meters 26
220 MHz 38
40673 MOSFET 65
12AT7 RF amp 50
12BY7A PA 65
1N4148, 1N914 22
2N3553, 2N3866, 2SC2075 22
6AK4, 6AK5, 6AQ5 50
American Electronics 39
amplifier, DMOS project 38
antenna tuners 42
Antennas West 54
ARRL contest, 10 GHz 70
BBS 9
BC 107 transistors 65
butane soldering iron 36
CIO crystals 66, 68
Clear Channel Corp. 30
Collins Microwave 71
Colpitts VFO circuit 65
construction tips 24, 49, 76
corrections 11
CW 65
DARA 9
DC-DC converter 61
decoding telemetry 58
demodulators 72
DXing 65, 88
education 84
emergency operations 11
equipment repair 74
etching PCBs 22, 24
F6FNU, Antoine Baldeck 88
France 86, 88
G3IGU, Keith Coates 26
G3RUH, James R. Miller 58
G3YCC, Frank Lee 65
G4FAI, Tony Smith 44
GC-Thorsen 36
glossary 4
hambassadors 86
Hartley circuit 20
Henry Radio 40
Home-Brew contest 9
Hosfelt Electronics 40
Israel 9
Jan Crystals 40
Japan 11
Jones circuit 50
K3ZJ, David Siddall 9
K7UGA, Barry Goldwater 81
KB1UM, Michael J. Geier 14, 74
KVG filter 65
LM380 IC 65
M/A COM Gunnplexer 70
Malta 87
manuals, old equip 11
MD108 65
Meadowlake Corp. 24
MFJ Enterprises, Inc. 42
MFJ Model 986 tuner 42
MGR Software 72
MHz Electronics 40
Microsats 60
microwave operation 70
Midland Technologies 24
mobile 82
MOSFET transistors 40
MRF 476 22
N1BLH, Marc Stern 30, 82
N5HNN, Bill Heishman 20
NE555 circuit 65
no-code 9, 81, 84
Nordlink 34
Norfolk Island 87
NZ5G, Bruce Auld 20
OSCAR 58
oscillators 65
packet 35
PL-259/SO-239 connectors 82
propagation 95
QRP operation 20, 26, 44
QSL mismanagement 88
radar device 70
Ranger AR-3500 30
REF 88
SOLFAN 70
SL610C RF amp 65
SL612 IF amp 65
Software 2000 34
software piracy 34
solar activity 9
solar energy 54
South America 87
Soviet Union 11
Sovonics P-201 panel 54, 56
SWR 46
Tanner Electronics 24
Ten-Tec 80
test equipment 40
transceiver construction 20
Triad M4Z trans 51
troubleshooting 49, 74
TU for RTTY 72
"Tucker Tin" circuit 65
Uniden mod update 11
Uo-SAT-D 60
uplink/downlink freqs 60
VP2ML, Chod Harris 88
W6YUY, Robert E. Bloom 38
WA3AJR, Marc I. Leavey, M.D. 72
WA3IAC, Chuck Steer 61
WA3JUF, D. Mascaro 61
WA4BLC, Bill Clarke 42
WA6ITF, Bill Pasternak 81
WB2KQI, Neil Shapiro 34
WB6IGP, C.L. Houghton 70
WB8VGE, Mike Bryce 54, 76
WB9RRT, Larry R. Antonuk 36
Wilson Antenna 82
XR-2211 demod 72
Yaesu FT-411 HT 14
Youth Net 11
YU1FR (ex), Tima Popovich 50

COMPUTERIZE YOUR SHACK

Control up to eight digital radios simultaneously from your MS-DOS microcomputer! DataCom, Inc. offers a series of software/hardware packages that interface with many current synthesized rigs. These include:

ICOM 735, IC-761, IC-781, IC-R7000, IC-R71A
Yaesu 747, 757GX, 757GXII, 767, 9600
Kenwood TS-440, TS-940, TS-140, TS-680, 711, 811, R5000

Datacom couldn't be simpler to install. The user doesn't need to know anything about MS-DOS—the installation program does it all! After installation, the user sets the parameters with menus.

These packages allow complete control of these rigs from the keyboard, and more! Datacom adds:

- *Scan functions added to radios that don't allow this from the front panel.
- *Frequency and associated info memory limited only by disk storage.
- *Tabular screen display of all of the channels stored in memory, along with a full description of each, including:
  - —mode (LSB, USB, FM, etc.)
  - —eight character alphanumeric description
  - —signal bandwidth
- *continuously variable scan delay from 100 milliseconds up
- *a full-featured logging utility

AVAILABLE FOR IBM PC, XT, AT, 80386 256K RAM
1 SERIAL PORT AND 1 FLOPPY MINIMUM

PROGRAM WITH INITIAL LIBRARIES 99.95
RS-232 TO TTL INTERFACE ONLY (NEEDED IF DON'T HAVE MANUFACTURERS INTERFACE)
EXTERNAL INTERFACE ALLOWS 4 RADIOS 99.95
INTERNAL PC INTERFACE W/1 SERIAL & 1 RADIO PORT 129.95
SPECTRUM ANALYZER MODULE (CALL FOR PRICE)
COMPLETE SYSTEMS INCL. RADIO, INTERFACE, COMPUTER, AVAILABLE (CALL FOR PRICE)

DATACOM, INT.
8081 W. 21ST LANE
HIALEAH, FL 33016
AREA CODE (305) 822-6028

CIRCLE 147 ON READER SERVICE CARD

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

Well, I heard you. With the responses to the March 1989 RTTY Loop Reader Survey pouring in (I mean it—you really *did* respond to this one!), many of you made one thing quite clear. You are anxious to anger your spouse, parent, or significant other and burn little holes in the kitchen table with a construction project or two. Glad to oblige.

The most-asked-for items by far were small, one- or two-chip, or transistor projects useful to the RTTYer, new or old. Simple demodulators and AFSK units led the pack, with other types of test or interfacing circuitry following. With these requests ringing in my ears, let's see what I can muster up.

The TU, Demodulator, and Modem

Receiving RTTY is the first item of business, and that requires a terminal unit of some kind. Early in this hobby, the device that decoded the bloodle-bleeps of RTTY into the clunky-chunks of TTY was called a "Terminal Unit," probably because it was the electronic unit used at the terminal. Commonly abbreviated TU, this term is still quite widely used. A bit later, the moniker "demodulator" surfaced, derived from the demodulation of frequency shift keying into TTY loop voltages. We also still hear the phrase "truncate to demod." Recently, an interface that both sends and receives, modulatos and demodulates so to speak, is called a "modem," from the initial syllables of these two words. Originally a computer term, it has crept into our vocabulary as well.

However you wish to call it, our goal is to make a simple device which will convert frequency-shifted audio tones into a keyed voltage. The heart of this circuit is a demodulator on a chip, the XR-2211 phase-locked loop demodulator. Although not in the latest Radio Shack catalog, it used to be carried on their parts wall, and it may be in the clearance bin at many stores. If not, Radio Shack dealers can order one for you. Also, you can buy it at many parts stores and by mail order; the Jim-Paks line carries it.

All other components in this project are common parts. You can buy them at Radio Shack or other parts houses. I recommend building the device on a small piece of perf board, with point-to-point wiring. Clubs may wish to etch a circuit board; this could be a useful introductory project.

The Demodulator

Now, to the matter at hand. Figure 1 is a schematic diagram of the demodulator. The audio output of your receiver, either HF or VHF, is coupled to the demodulator through a 0.1 µF capacitor to pin 2 of the XR-2211. With no input filtering on this device, it is important to present a clean signal, either a good VHF RTTY signal or a strong, interference-free HF signal.

A phase-locked loop (PLL) demodulator is normally tuned for the frequency and bandwidth desired. Here, the 0.022 µF capacitor from pin 13 to pin 14 of the integrated circuit and the 20 k resistor (an 18 k fixed and 5 k variable) on pin 12 set the center frequency to about 2125 Hz, midway between a 2025 Hz mark and 2225 Hz space frequency.

Set the bandwidth to allow 300 baud transmission with the 200 k resistor between pins 11 and 12. The filter of the 0.005 µF capacitor and 100 k resistor coming from pin 8 provide additional trimming.

Naturally, with a circuit operating at TTL levels, the output from this one-chip wonder is at TTL levels. Don't try to drive a Model 15 with it—at least, not directly. Future columns will include some interfacing schemes that will let you do this.

> ***"MODEM MGR . . . supports split-screen operation or full screen at speeds to more than 19KB, and it will run under either ProDOS or Apple DOS 3.3."***

Apple News

In the March issue of RTTY Loop, I mentioned Byron Schulten's Apple woes, but somewhere between my data transmission and the typesetter, his computer mutated from an Apple IIgs to an Apple IIe. Well, Bruce Klutchko, M.D. WB2HLX, Hastings-on-Hudson, New York, offers his advice regarding a piece of software called MODEM MGR. Bruce says that he has used this program for several years, and has found it one of the most comprehensive and well-supported programs available for the Apple II+, IIc, IIe, or IIgs. It supports split-screen operation or full screen at speeds to more than 19KB, and it will run under either ProDOS or Apple DOS 3.3.

Bruce notes that Apple users sometimes feel orphaned by the amateur industry, but they're reluctant to give up their machines. He feels that MODEM MGR speaks to that need precisely. It is available from *MGR Software, Suite 101, 305 So. State College Blvd, Anaheim CA 92806.* Contact them for current pricing and availability, and be sure to mention *73's* RTTY Loop when you write.

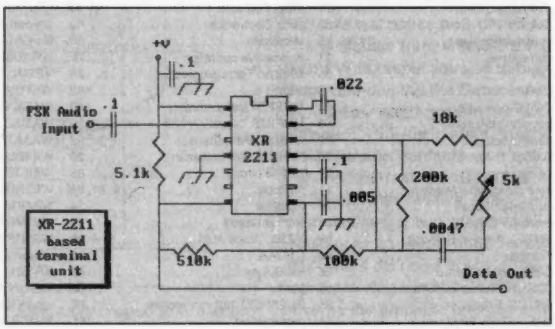
Next—Transmitting

Next, we'll cover the other side, transmitting, with a one-chip RTTY modulator. As always, I welcome your questions and comments, either by mail or E-mail. Send paper to the above address, E-mail to me on CompuServe (75036,2501) or Delphi (MARCWA3AJR) with your comments, questions, suggestions, or criticism. All of it is appreciated. 73

Demodulator Parts List

Integrated Circuit	XR-2211	Jim-Paks or mail order	
***Resistors** ¼ or ½ Watt	5100Ω	RS 271-1330	5/$0.39
	18000Ω	RS 271-1337	5/$0.39
	100kΩ	RS 271-1347	5/$0.39
	200kΩ	RS 271-1350	5/$0.39
	510kΩ	RS 271-1354	5/$0.39
Potentiometer Miniature PC mount	5000Ω	RS 271-217	$0.69
Capacitors Precision disk	0.022 µF	RS 272-1066	2/$0.69
	0.005 µF	RS 272-130	2/$0.49
	0.0047 µF	RS 272-130	2/$0.40
	0.1 µF x 3	RS 272-135	2/$0.59
Perf board	0.1" grid	RS 276-1394	$1.99

*Resistor values are nominally within 10%. For all practical purposes, the available Radio Shack values are close enough for this project to the specified values. If you can get exact values, fine. If not, don't lose any sleep over it.



SUPER PERFORMANCE BATTERIES

SUPER ICOM

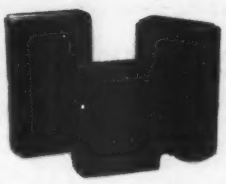
SUPER ICOM BP-7S, 13.2 volts, 900ma, double the capacity of the Icom BP-7, 5w output.

SUPER ICOM BP-8S, 9.6 volts, 1200ma, 50% more capacity than the Icom BP-8.

Both are rapid base charge only, or slide in wall charger, 4 inches high. BP-7S or BP-8S. $69.00.

SUPER KENWOOD

SUPER KENWOOD PB-25S/PB-26S. 8.4 volts, 900 ma, double the capacity of the PB-25/PB-26 for the 2500/2600/3500/3600. Charge with either the standard wall charger or drop in charger. 3 inches high. $65.00.



Exact replacement FNB-2 Nicad pack for Yaesu FT-404R/207R/208R/708R $27.00.

SUPER YAESU

SUPER YAESU FNB-4SH, 12 volts, 1000ma, double the capacity of the Yaesu FNB-4, 5 watt output. Rapid charge only. $71.00

SUPER YAESU FNB-3S, 9.6 volts, 1200ma, triple the capacity of the Yaesu FNB-3, 3.5 watt output. Rapid or wall charge. $60.00

Both are perfect for the 03, 09 and 727 series radios and are 4 inches high.

Inserts for:	
Kenwood PB-25, 25H, 26	$29.00
Icom BP-3	$22.00
Icom BP-5 (500ma)	$30.00
Icom BP-7 (500ma)	$35.00
Icom BP-8	$34.00

Add $4.00 shipping & handling for first pack. CT residents add 7½% tax.

Complete line of NICAD packs for Icom, Kenwood, Yaesu, Tempo, Santec, Azden, Cordless Telephones, Alkaline, Nicad, and Gell-Cells. All NICAD packs include a 1 year guarantee. Commercial Radio Packs also available.

For all your battery needs, write or call today for a complete catalog. Dealer inquiries invited.

Made by Hams for Hams

VISA

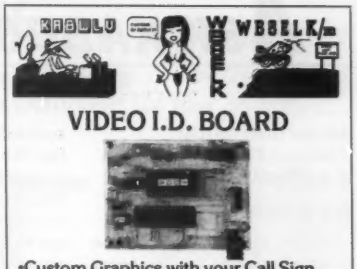
PERIPHEX Inc.

149 Palmer Road • Southbury, CT 06488

(800) 634-8132 In CT (203) 264-3985

DISCOVER MasterCard

CIRCLE 68 ON READER SERVICE CARD



VIDEO I.D. BOARD

- Custom Graphics with your Call Sign
- 4 Screens (2 Hi-res/2 color bar)
- 12 VDC Operation
- Instant Video ID
- Video Relay for switching in Live Camera Video
- Built-in Automatic Sequencer-Timer (steps through all four screens)

VDG-1 with pre-programmed calls:

$89

Call or write for catalog of available graphics

ELKTRONICS

12536 T.R. 77 • Findlay, OH 45840

(419) 422-8206

CIRCLE 8 ON READER SERVICE CARD

Power Pole® Connectors

Tired of looking for power connectors for all those rigs?

The Power Pole® system is for you! Shack to mobile just Plug & Go!

- 15 - 30 - 60 amp @600 volt AC/DC ratings
- Genderless! All connectors mate.
- Polarity is determined when multiple poles are assembled.
- Cannot be mated incorrectly!
- Silver plated contacts mean low resistance(600 micro ohms/PP30)
- Easy to assemble, crimp and/or solder.
- Dovetail assembly allows "stacking" multiple poles as needed.

Powerpak 15 - 4 or 30 - 4 with 2 red & 2 black poles **Just $1.99**

(*2.** shipping and handling up to 50 pks. *10 min. order)

Distributed By: **Reighcon Systems**

626 S. Blue Sky Dr., Cedar City, UT 84720

Dealer inquiries Welcome (801) 586-2302

CIRCLE 347 ON READER SERVICE CARD

5-1000 MHz PREAMPLIFIERS

	NF	G	P(1 dB)	$
WLA20M*	2dB	15dB	0dBm	73
WLA21M	3	13	8	57
WLA22M	4	11	12	61
WLA23M	4	22	12	87
WLA24M	3	23	18	109
WLA25M	5	11	20	82
WLA26M	6	21	24	199

Add $4 for S&H; *BW 1-500 MHz

WILAM TECHNOLOGY, Div. of

WI-COMM ELECTRONICS INC.

P.O. Box 5174, MASSENA, N.Y. 13662

(315) 769-8334

CIRCLE 319 ON READER SERVICE CARD

Short Broadband Dipoles & Slopers

Trapless 3-conductor legs create short antenna with broad 2- & 3-band resonance.

FB Dipoles

FB 80/40/15 62' (• CW • Center • LSSB • USSB) $79.95

FB 40/20 31' $69.95

FB 20/10 16' $59.95

When ordering add $5 P&H

Infopack $1

Box 50062-S, Provo, UT 84605

Trapless 2 & 3 band Tower-Mount **FB HalfSlopers**

FB 160/80/30 CW 70'

FB 160/75 SSB 62' $69.95

•2KW •Efficient •Coax Fed •Ready to Use •No Caps or Coils •Fully wx sealed & insulated

AntennasWest

(801) 373-8425

CIRCLE 303 ON READER SERVICE CARD

You Bet Minnesota

YAE-SU!

Satellite City

12581 Central Ave., Mpls, MN 55434

SATELLITE CITY Communications for the Future

JUNE MOBILE MONTH!

National 1-800-426-2891 Local 1-612-754-1200 State 1-800-328-8322, Ext 176

CIRCLE 332 ON READER SERVICE CARD

ASK KABOOM

The Tech Answer Man

Michael Geier KB1UM
7 Simpson Court
S. Burlington VT 05403

Fix or Ship?

Previous columns covered how to fix your radios—an important part of the ham experience. There comes a time, however, when it makes sense to send the rig back to the factory, even if you are a very skilled technician, and especially if you're not. This column is about determining the cutoff point between "I can fix this!" and "Where's the shipping box?"

Technical Skill

One very important factor is your confidence in your ability to repair your rig. With the cost and complexity of today's rigs, you don't want to get in over your head and make mistakes that can result in tremendous repair bills later. This ability varies widely among hams, and seems unrelated to class of license. Some hams are just more into the mechanics of the technology than others.

Manufacturers discourage owner-performed repairs, and it makes good economic sense for them to do so. For one thing, they make money when you send the rig in, unless it's under warranty. Also, they maximize their profit by fixing the most units per day possible. If a technician has to spend several hours wading through an owner's botched repair job, the company makes less than it would if he could fix several units during that time. The problem is compounded by the fact that the tech often has no idea how to separate the original problem from what the owner has done to the rig!

Warranty Service

Warranty service from manufacturers can be very slow—you wait up to several months to get your radio back. This makes it tempting to fix it yourself, but it just doesn't make sense to open up your rig while it's still under warranty. If you tamper with it and then have to send it in anyway, it will automatically be classified as "out of warranty." You will be charged the regular rate, even if your intrusion is unrelated to the malfunction.

This doesn't apply, of course, to the installation of factory options, such as filters, FM boards, and the like. The basic purpose of warranty service is to correct "infant mortality," or the sudden malfunction of a new product. It is axiomatic, and true, that a solid state device will tend to either die within a week, or work for years. Hence the standard 90-day warranty. Although the trend is toward longer warranties, they are a pretty safe bet on the part of the companies. So are extended service contracts.

Fixing vs Tweaking

One thing I've found about warranty service is that it's just about impossible to get a radio adjusted unless it is so far out of whack that it's practically unusable. As far as manufacturers are concerned, it either works or it doesn't. So, if you are unhappy with, say, the alignment of an oscillator frequency, live with it until the warranty runs out, and then adjust it yourself.

The Big Decision

Now the rig is out of warranty, and it stops working. What to do?

The basic strategy is this: Weigh the chances of a successful repair against those of making things worse. This does not have to be a purely emotional gut reaction. You can approach it in a logical manner.

First, ask yourself whether you have an idea about what is wrong with the darned thing! Sometimes the problem will be obvious to you, and other times it will be a big mystery. Even if it's a mystery, you can still tackle it yourself, as long as you feel competent to do so.

Next, ask yourself whether you have the equipment to do the job. The first order of business here is a schematic diagram. To delve into the rig without one is just asking for major trouble. Look at your test gear. If you suspect a power supply malfunction, perhaps a VOM will do, but do you really want to dive into a PLL problem without a scope?

Finally, weigh your time versus the expected repair costs. A job that will take you 14 hours to puzzle through, but may only cost $60 at the shop, is probably not worth doing, unless you have lots of free time (free what??), or you just want to play with it on weekends, in which case it will probably sit broken even longer than it would at the service center!

Getting Parts

They say that in Australia, parts are plentiful because there are lots of electronics enthusiasts. That's certainly not the case here in the good old U.S.A. Chances are that you'll wind up having to order parts from the manufacturer. Expect to get soaked. I was recently charged $11.70 for a chip that should have cost no more than $3.00! Manufacturers mark up parts very heavily. (An exception is Yaesu. Parts I've ordered from them have been very reasonable.) In any event, at least the labor (yours) is free!

Now, let's look at this month's letters:

"a new solid state device will tend to either die within a week, or work for years."

Dear Kaboom,

Why does the last digit on the frequency display of my TS-130S sometimes drift up and down, while my friend's TS-440S is absolutely stable? Is there some way I can make mine stay put?

Signed,
Wanderin'

Dear Wanderin,'

The answer lies in the fundamental difference between the two radios. The older '130 has an analog VFO, and the display is a type of frequency counter. As the VFO and/or counter drift, the number wanders. The '440, however, is a digitally synthesized rig. The display is generated by the microprocessor, and has nothing directly to do with the actual frequency of the radio. The computer also controls the synthesizer to put the radio on the displayed frequency. In other words, the TS-130's display follows the radio, and the TS-440 works the other way around.

Dear Kaboom,

The middle segments of all the numbers in the digital display on my Kenwood TS-120S have gone out. Otherwise, the radio works fine. But it sure is hard to tell what frequency I'm on; the numbers look like something from another planet! Where should I look?

Signed,
Half-Digit

Dear Half,

The likely culprit is the TC5066BP, IC16 on the counter board. This chip is a display-tube driver, and it controls the middle segment. The part is available from Kenwood. The board is just behind the display. Be careful not to break the delicate display tube when you pull the assembly to change the chip.

Dear Kaboom,

I have a modern digital HF rig, and when I tune through the bands, there's an annoying thump in the audio every 10 kHz. It's especially noticeable on AM signals. I called the company, and they said it was normal, but my cousin's identical model doesn't do it, and his is two years older! Are they lying to me or what?

Signed,
Thumper

Dear Thumper,

No, they're not. If you've been reading ham mags in the last year or two, then you've read about phase noise in synthesized rigs. It's a sort of modulation of the oscillators, caused by the digital control process. It degrades a radio's performance, and the manufacturers have been trying to improve the situation. The current fix is to make the phase locked loop tighter by decreasing the loop filtering, and it works.

Unfortunately, it also causes some overshoot at certain frequency intervals, and this is what causes the audio thump. Your cousin's unit was made before the mods went into effect.

Have a tech question? Send it off to "Dear Kaboom" at the above address.

SPECIALISTS IN FAST TURN P.C. BOARDS

PROTO TYPE P.C. BOARDS
AS LOW AS $25.00

- SINGLE & DOUBLE SIDED
- PLATE THROUGH HOLES
- TEFLON AVAILABLE
- P.C. DESIGN SERVICES

FOR MORE INFORMATION

Midland Technologies

34374 EAST FRONTAGE ROAD
BOZEMAN, MT 59715 (406) 586-1190

CIRCLE 252 ON READER SERVICE CARD

PC Slow Scan $149.95

A complete slow scan television station for your IBM PC or compatible. Send and receive images in up to 10 shades of gray depending upon your graphics card and printer.

Includes:
Demodulator Modulator 75 Page Manual
Software Tutorial Cassette

Requires:
Ham transceiver PC with 640K Parallel Port
Graphics Card Tape Recorder Serial port

Slow Scan Formats: 8,12,17,23,34,36,48,72 sec.

Software Systems Consulting
1303 S. Ola Vista
San Clemente, CA 92672
(714) 498-5784

CIRCLE 244 ON READER SERVICE CARD

CATALOGS

HAM	SWL
➤Transceivers	➤Receivers
➤HF-VHF-UHF	➤Antennas
➤Antennas	➤Tuners
➤RTTY-Packet	➤Heaphones
➤Receivers	➤RTTY-FAX
➤Books & Accs.	➤Books & Accs.
HUGE 48 page 8½ by 11" format. With prices! ONLY $1 Postpaid	HUGE 52 page 8½ by 11" format. With prices! ONLY $1 Postpaid

Send to:

Universal Radio
1280 Alda Drive Dept. 73
Reynoldsburg, OH 43068

Serving Amateur Radio Since 1942

NEW! AZIMUTH WEATHER STAR

A Power-Packed Micro Weather Computer for Your Station... by DIGITAR

Complete ONLY $159.95 Plus S&H

PLUS FREE BONUS CALL TODAY!

Protect Your Antenna & Home!

A must in every shack. Now you can scan...heavy Wind Gust...Wind Direction... Temp Hi/Lo and more! Get your own computerized weather station at an incredibly low, affordable price.

The New Azimuth Weather Star by Digitar is a high quality, power-packed weather computer, just loaded with features. Gives you accurate weather data...right in your shack...at the touch of a finger. Created with the latest CMOS micro-chip technology.

You Get All These Exciting **FUNCTIONS & FEATURES** with the TW2...

HANDY, COMPACT SIZE: 2½" × 2½" × 1½"
LARGE, EASY TO READ LCD READOUT Gives you Wind Speed • Records High Wind Gusts • Wind Direction • Wind Chill Factor • Outside Present Temperature (Remote sensor included) • Records High/Low Temperature • Reads in Fahrenheit, Celsius, Miles/Hour, or KM/Hr • Programmable Scan! • Operates on DC (Batteries Not Included) or AC with Optional adaptor.

Your **TW2 SYSTEM COMES COMPLETE WITH** • TW2 Weather Computer • Anemometer & Wind Vane made of high impact, UV resistant plastic, with stainless bearings & shaft for years of trouble free service • 40 Feet of Cable lead-in with connectors • Outside Temperature Sensor • & Mounting Hardware •

And it's MADE IN AMERICA! YOUR SATISFACTION GUARANTEED! Or return in 10 days for a complete refund!

1 YEAR Limited WARRANTY from Manufacturer!

Your SPECIAL Order TODAY!

Get the famous Azimuth World Time, Dual-Zone 24-Hour Station Clock. Displays Local & Intl in 15 Cities/Zones. ***Retail Value $29.95***

ACT NOW! SEND TODAY!

AVAILABLE OPTIONS:
• Stainless Desk Stand (DSK22) @ $9.95 • Rechargeable Ni-Cad Battery Pack (BP3) @ $7.95 • 40 Ft. Extension Control Caule (EC40) @ 14.95 (Requires 2) • AC Power Adaptor (PS12) @ $9.95 • Please add $3.95 for Shipping & Handling of TW2. For each option add $1.00.

CREDIT CARD ORDERS ONLY

Other Service Call 213-473-1332
(9AM to 6PM PST) Ca. Res. add sales tax.

AZIMUTH WEATHER STAR
11845 W. Olympic Bl. Suite 1100, Los Angeles, CA 90064 USA (Dept. A8)

ALSO AVAILABLE AT HENRY RADIO & ALL HAM RADIO OUTLETS!

CIRCLE 158 ON READER SERVICE CARD

PacComm

- *Advanced Technology*
- *Enduring Value*

9600 Baud Packet System

Introducing the next generation in packet performance: A complete line of affordable 9600 baud packet equipment to support both network nodes and local packet users. The modem is based on PacComm's successful 9600 baud commercial modem design (exclusively licensed from James Miller, G3RUH). It is a high performance FSK design using innovative signal processing techniques to comply with FCC bandwidth limitations on the 6 and 2 meter amateur bands as well as higher frequencies. The modem connects to the radio internally and may not be suitable for use with all existing radios.

Other packet manufacturers plan to offer equipment compatible with the PacComm 9600 Packet System.

We accept major credit cards. Order Toll Free:
1-800-223-3511
Technical support line:
(813) 874-2980

MODEM CARD - Add on internal modem card for TNC-2 and clones, and all PacComm TNCs... $99.95 fully tested and ready to install. (Avail. Now)

EXTERNAL MODEM - Encased 9600 baud modem with front panel LED displays and cabling for most popular packet controllers including the PK-232... $159.95. (Avail. late April)

HIGH SPEED DIGITAL RADIO - Digital transceiver consisting of digital 2-5 watt RF deck and 9600 baud modem. $329.95 to $399.95 (Avail. in May)

COMPLETE HIGH SPEED PACKET UNIT - Integrated digital transceiver, packet TNC, and 9600 baud modem ready to attache to your computer or terminal and antenna... $449.95 to 519.95 (Avail. in June)

***PacComm** • 3652 West Cypress Street • Tampa, Florida 33607*

Please send info on: ☐ _____ ☐ *FREE Catalog*

Name _____ Call _____

Address _____

State _____ Zip _____ Card# _____ Exp. Date _____

MONEY BACK GUARANTEE! *Add $4.00 shipping/handling per order. FL residents add 6% sales tax. Major Credit Card give number, expiration and signature.* *FAX: 813-872-8696*

CIRCLE 152 ON READER SERVICE CARD

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon, OH 44646

Building one's equipment is a lot of fun—great fun, in fact. On the other hand, it sure is no picnic when you're all done, and then nothing happens. So, we'll take a close look at getting that dead radio to fly with some simple troubleshooting technique.

Before you start to construct any project, give the schematic a good look over. You will occasionally discover errors and, somewhat more often, important omissions in product documentation and magazines. Look over the schematic for proper Vcc connections, ground points, input/outputs, and other important details. In many cases, the Vcc pins are not marked in schematics, assuming that everyone knows that pin 14 of a 4011 chip is Vcc and pin 7 is ground. Of course if you don't know that, and you don't connect the pins to the proper points, the circuit just won't work! Aside from that, there are zillions of reasons for a non-working project. Let's take a look at several of those reasons this month.

The Approach

Other than looking for errors in the schematics and wiring, what do you do? Break the problem down into small bite size pieces. You'll need some rather simple test gear, including a good quality VOM, either an analog or digital model. You'll also need a logic probe for those digital projects, and a variable power supply. The supply should sport a current meter.

Now for the troubleshooting. First things first. Just what is the project doing? Or not doing? Just because the transmitter has no output doesn't necessarily mean the circuit is totally dead. Let's connect our small transmitter to the power supply. With the ammeter monitoring the current being drawn, we can get a reasonably clear picture of what is going on. After you power up, what kind of current do you see flowing? Depending on the type of circuit you're working on, you should see some current being drawn by the oscillator(s). Key the transmitter. Does the current go up? If not, then either you're not applying a key voltage to the PA, or the PA transistor is defective. Remember, most failures occur because of heat. The PA transistor and the power supply pass transistors generate heat, so you should watch those parts. If you don't see any current being drawn by the circuit, check for Vcc on the oscillator.

What do you do if your dead project has a self-contained power supply? Well, don't laugh, but be sure that it's plugged into a live outlet. Check for the proper voltage coming out of the power supply. Look for internal fuses. Some transformers use a fused primary wire inside the transformer. When these go, you can't fix them, short of replacing the defective unit.

Another common problem with power supplies is that there may be steering diodes used for battery/AC operation. Check these diodes with your VOM.

Without the oscillator, you'll not get a microwatt of power out. You can check for proper oscillator operation with either an RF probe or a general coverage receiver. I use a frequency counter on my bench. A small two or three loop pickup coil will sniff out the RF. I won't get into PLLs. They can cause a lot of trouble and are beyond the scope of this column. In troubleshooting most simple two or three transistor QRP transmitters, check the oscillator first. Next, check for output of the oscillator. A coupling capacitor may be at fault. From the oscillator, check for output at the buffer transistor (if used). If all is as it should be, but there's still no output showing at the antenna, check for Vcc on the PA transistor.

Now check the output coupling capacitor. Capacitors rarely go bad, but sometimes you pick out a dud from the junk box. An out-of-tolerance capacitor can cause you a lot of fuss.

Next in line to look at is the transmitter. Does it use TR/switching? If so, check the diodes. A shorted diode will cause the output to come up zero. In this case, monitor the current meter on the power supply. It should show normal current, perhaps even draw more current than it should. If that is the case, check the output section for a short. You can use your VOM to find a DC short, but not an RF short caused by a capacitor breaking down under the presence of RF. In this case, use a WCF. A WCF? Yup, a Well Calibrated Fingertip.

Happy, healthy capacitors don't get hot during operation. With your fingertip, check the output capacitors. (With the power off! No RF burns, please.) If you find a warm capacitor, replace it. I also use this technique when troubleshooting computer mother boards. All those 0.1 µF caps on each chip. It has saved me a lot of time. Take care, however, to ground yourself when using this method when working around components such as CMOS chips. Static electricity can kill these components.

After you get some troubleshooting time under your belt, the WCF will save you a lot of grief. PA transistors, audio power amplifiers, and other heat producing devices all run warm. You can tell just how well the device is doing just by the amount of heat it generates. Regulator ICs should be warm. If not, then the circuit is not drawing much current, or none at all. If the regulator is steaming hot, too much current is being drawn.

After exhausting all the easy-to-fix problems, we have to look a bit deeper into the circuit. I've always had a hard time with fixing a radio that I did not build. However, I've had some luck by having someone look over my work. Sometimes, after spending hours and hours looking over a circuit, you just can't see the problem. A friend can sometimes pick out the trouble in a few seconds!

continued on p. 80

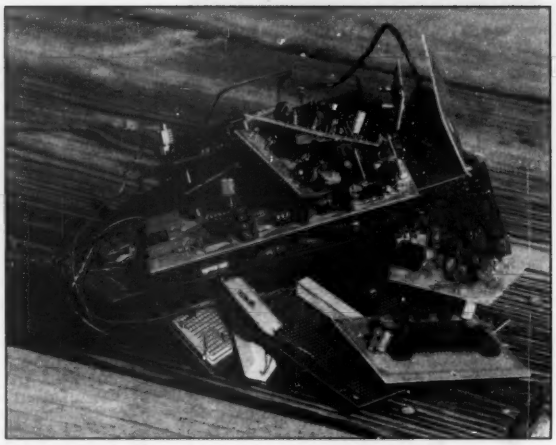


Photo A. Some of the projects that didn't quite make it. . .

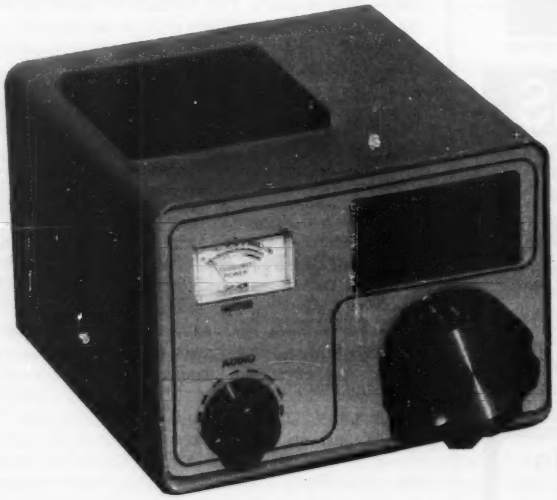


Photo B. A little home-brew unit that sports a VMOS power amp and a direct conversion receiver.

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

KIT, ONLY $675

WIRED $975

VHF OR UHF

FEATURES:

• **SENSITIVITY SECOND TO NONE! GaAsFET front end** on vhf models gives 12dB SINAD of 0.12uV (vhf), 0.15uV (220). UHF model 0.25uV std, 0.1uV with optional helical resonator preamp.

•**SELECTIVITY THAT CAN'T BE BEAT!** Both 8-pole xtal filter & ceramic filter for >100dB at only ±12kHz. Helical resonator front end to combat desense & intermod.

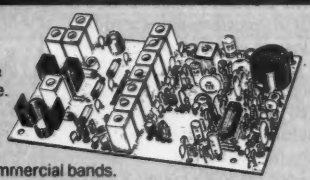
•**CLEAN, STABLE TRANSMITTER,** up to 18W output standard; 50W with accessory power amplifier.

•**FCC TYPE ACCEPTED** for commercial high band and uhf.

•**Courtesy beep,** field-programmable CWID, flutter-proof squelch, automatic frequency control to compensate for off-frequency transmitters (all standard features).

•**Full range of options** available, such as autopatch, phone line or radio remote control, sub-audible tones, duplexers.

HIGH PERFORMANCE TRANSMITTERS & RECEIVERS FOR REPEATERS AUDIO & DIGITAL LINKS, TELEMETRY, ETC.



•**FM EXCITERS:** Kits $99, W/t $179. 2W continuous duty. TCXO & xtal oven options available.

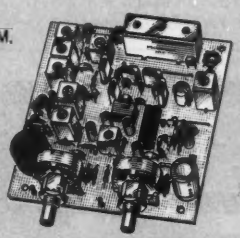
•**TA51 for 10M, 6M, 2M, 150-174, 220 MHz.**

•**TA451 for uhf.**

FCC type accepted for commercial bands.

•Call for latest information on 900 MHz transmitters.

•**VHF & UHF AMPLIFIERS.** For FM, SSB, ATV. Output from 10 to 50 Watts. Several models, kits starting at $79.



•**R144/R220 FM RECEIVERS** for 2M, 150-174, or 220 MHz. **GaAs FET** front end, 0.12uV sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere)! Flutter-proof squelch. AFC tracks drifting transmitters. Kit $149, w/t $229.

•**R451 UHF FM RCVR.** Similar to above. Tuned line front end, 0.25uV sens. (0.1uV with optional hel. res. preamp). Kit $149, w/t $229.

•**R901 FM RCVR FOR 900 MHZ.** Triple-conversion, GaAs FET front end, 0.2uV sens. Kit $169, w/t $259.

•**R76 ECONOMY VHF FM RCVR** for 10M, 6M, 2M, 220. Without hel res or afc. Kits only $129.

•**Weather satellite & AM Aircraft receivers also avail.**

FCC TYPE-ACCEPTED TRANSMITTERS & RECEIVERS AVAILABLE FOR HIGH-BAND AND UHF. CALL FOR DETAILS.

GaAs FET PREAMPS

at a fraction of the cost of comparable units!

LNG -(*)

GaAs FET PREAMP

ONLY $59! Wired/tested

FEATURES:

•**Very Low Noise:** 0.7dB VHF, 0.8dB UHF

•**High Gain:** 13-20dB, depending on frequency

•**Wide Dynamic Range:** to resist overload

•**Stable:** new-type dual-gate GaAs FET

** Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW -(*)

MINIATURE GaAs FET PREAMP

ONLY $24/kit, $39 Wired/tested

GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

** Specify tuning range desired: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*)

IN-LINE PREAMP

ONLY $79/kit, $99 Wired/tested

GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W.

**Specify tuning range desired: 120-175, 200-240, or 400-500 MHz.*

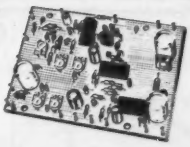
HELICAL RESONATOR PREAMPS

Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

MODEL HRA-(*), $49 vhf, $84 uhf.

** Specify tuning range desired: 142-150, 150-162, 162-174, 213-233, 410-454, or 454-475.*

ACCESSORIES



COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier. $49

CWID kit. Diode programmed, adjustable tone, speed, and timer, to go with COR-3. .....$59

NEW **COR-4** kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call letters..$99

NEW **TD-3 SUBAUDIBLE TONE DECODER/ENCODER** kit. ...$24

TD-2 DTMF DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch and phone line remote control are std. $79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation. $39

MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

DE-202 FSK DEMODULATOR kit. For receive end of link. $39

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of new MO-96 Modem and special versions of our 220 or 450 mHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W. *Call for info on the right system for your application!*

RECEIVING CONVERTERS

		Antenna Input Range	Receiver Output
		28-32	144-148
		50-52	28-30
		50-54	144-148
VHF		138-139	28-30
		144-146	28-30
MODELS		146-147	28-30
Kit with Case	$59	146-148	28-30
Kit less Case	$39	220-222	28-30
Wired w/case	$89	220-224	50-54
		222-224	28-30
UHF MODELS		432-434	28-30
Kit with Case	$69	435-437	28-30
Kit less Case	$49	432-436	144-148
Wired w/case	$99	432-436	50-54
		439.25	61.25
		902-928	422-448
		902-922	430-450

See catalog for full line of 2w transmitting converters for vhf & uhf. Kits only $79. Linear Amplifiers avail. up to 50 w.

• **Send $1 for 36 page catalog by return mail.**
(Send $2.00 or 4 IRC's for overseas mailing)

•Order by phone or mail • Min $3 S & H per order

•Use Visa, Mastercard, Check, or UPS COD.

Our 26th Year

hamtronics, inc.

65-H MOUL ROAD•HILTON NY 14468-9535

Phone:716-392-9430 Hamtronics® is a registered trademark

CIRCLE 250 ON READER SERVICE CARD

Number 26 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

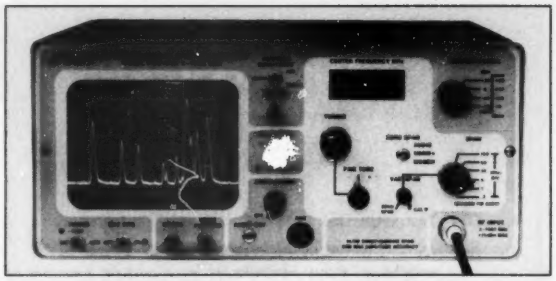
MODEL CCB RF DETECTOR

The hand-held Model CCB RF Detector from Optoelectronics will indicate the presence of a 1 mW transmitter within a twenty-foot distance. The bargraph display successively illuminates up to 10 segments as the distance to the transmitter decreases. This simplifies locating and deactivating the unauthorized transmitters, or "bugs," placed in rooms for listening to private conversations.

Other applications include checking the output from small or large transmitters used in radio telemetry, two-way radio, ham radio, garage door openers, RC transmitters, cordless and cellular phones, marine and aircraft radio, CB, police and emergency radio services.

The CCB has a two-stage wideband RF amplifier, and a forward biased hot carrier diode for a detector. The output of the detector is filtered and fed to the log output bargraph driver circuit. Each segment responds to a 3 dB step increase in signal strength. Screwdriver adjustable pots are provided for zero and full-scale adjustment.

The CCB RF Dectector is $100. *Optoelectronics, Inc., 5821 N.E. 14th Avenue, Fort Lauderdale FL 33334. (800) 327–5912 or (305) 771–2051.* Accessories include the Model TA-100S telescoping BNC antenna for $12 and the CC-12 vinyl zippered case for $10. Circle Reader Service Number 201.



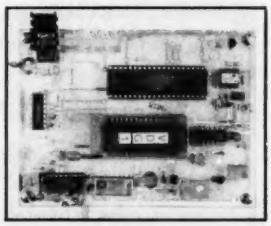
AVCOM

Avcom introduces a new portable spectrum analyzer, the model PSA-65A, which covers frequencies through 1000 MHz in one sweep with a sensitivity greater than −90 dBm at narrow spans. The light-weight PSA-65A, battery or line powered, was designed for 2-way radio, cellular, cable, LAN, surveillance, educational, production, and research and development work.

Options include frequency extenders for Satcom and higher frequencies, audio demod for monitoring, log periodic antennas, carrying case (AVSAC), and more.

Size—11½w x 5½h x 13½d; weight—18 lbs./8.18 Kg. Price, $2,675. Request brochure and spec sheet. *AVCOM of VA, Inc., 500 Southlake Blvd., Richmond VA 23236. (804) 794–2500. FAX: (804) 794–8284. TLX: 70-1545 AVCOM.UD.* Circle Reader Service Number 208.

ELKTRONICS



The Elktronics Video I.D. Board (VDG-1) provides a quick source of instant video especially useful for those active in ATV or SSTV. Four computer graphics screens (2 Hi-res/2 color bar) come on a custom-programmed EPROM with your callsign.

Since the VDG-1 operates from 12 volts DC, and measures just 3.75″ x 5″, it's ideal for ATV repeater identification or portable and mobile operation.

You can switch from the I.D. to live camera. An automatic timer/sequencer allows you to display all four graphics screens in various combinations. Price, $89. *Elktronics, 12536 T.R. 77, Findlay OH 45840. (419) 422–8206.* Circle Reader Service Number 210.

MEDIA MENTOR, INC.

The Codekey 1000 is a custom-made Code Practice Oscillator from Media Mentor, Inc. It is a practical, cost-efficient classroom tool for motivating children to enjoy practicing Morse Code. The Code Key Oscillator operates on a standard 9-volt battery, which is included in the price of $19.95.

Youngsters will love the hands-on experience of operating their own keys. Every child will want to have her and his own. This is a great fund-raising item for a school.

Call Carole WB2MGP's *Ham Radio Hotline* for information on this and other instructional products. *Media Mentor, Inc., PO Box 131646, Staten Island NY 10313-0006. (718) 983–1416.* Circle Reader Service Number 207.

BIRD ELECTRONIC CORPORATION

Bird Electronic's new model 4029 Power Sensor Calibrator was designed for use with its 4420-series RF Power Meters. In conjunction with a CRT or PC with a serial port, it provides in-field calibration of the power meters to within ±3% of a known RF standard.

A menu guides you through the calibration process. You connect the calibrator to a 4020-series RF Power Sensor, and drive it with a known amount of RF power at a specific frequency. You enter the power level, and the calibrator automatically calculates and stores a correction factor in the Power Sensor's memory for that frequency. Since calibration data is stored in the Sensor, rather than in the display unit, you can use any 4020-series Sensor, with any 4420-series Power Meter, with no degradation of accuracy.

The 4029 can add, delete, clear, and list calibration points for review. The unit also checks the validity of operator input and warns of incorrect responses. The calibrator comes with connectors for a standard 25-pin serial cable and the Power Sensor cable. Voltage is 115/230 volts AC, 50/60 Hz. Price, $1750. *Bird Electronic Corporation, 30303 Aurora Rd., Cleveland OH 44139. (216) 248–1200.* Circle Reader Service Number 202.

PERFORMANCE AND VALUE
WITHOUT COMPROMISE

KRP-5000 REPEATER

2 METERS-220-440

The first choice in
Transmitters - Receivers
Repeaters
Repeater Controllers
Power Amplifiers
Voice Mail Systems

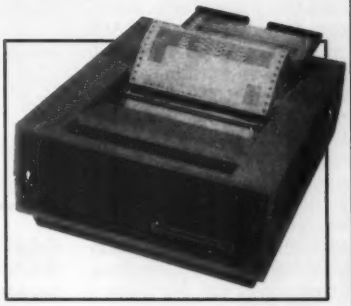
CIRCLE 295 ON READER SERVICE CARD

INDUSTRIAL PRINTER SALE

IDEAL FOR INVOICING, BUSINESS FORMS, PACKET RADIO, TELETYPE, OR ANY HEAVY PRINTING APPLICATION. WHY USE A GOOD LETTER QUALITY DOT MATRIX OR DAISY WHEEL FOR PRINTING INVOICES AND FORMS, MONITORING PACKET & RTTY WHEN A HEAVY DUTY DOT MATRIX PRINTER IS ALL THAT IS NECESSARY?

VICTOR 5080

- MADE FOR CONTINUOUS DUTY
- 4 INTERFACES STANDARD: PARALLEL, RS-232, TTY, IEEE-488
- BI-DIRECTIONAL
- 80 COLUMN—100 CPS
- FANFOLD OR ROLL PAPER
- RE-INKABLE RIBBON
- HANDLES 6 PART FORMS
- COMMERCIALLY SOLD AT $1195.00



NEW & FACTORY SEALED $109.00

FOR MORE INFORMATION, OR TO ORDER, PLEASE CALL:

HORIZON MANUFACTURING

▪ 690 GREENLEAF AVE., ELK GROVE, IL 60007 ▪

PHONE: 312-439-1234 FAX: 312-439—3799

ALL ORDERS SHIPPED BY UPS
IL AND TX RESIDENTS INCLUDE APPLICABLE SALES TAX

CIRCLE 308 ON READER SERVICE CARD

ASSOCIATED RADIO
8012 CONSER BOX 4327
OVERLAND PARK, KANSAS 66204

EVERY DAY A HAMFEST

BUY—SELL—TRADE

ALL BRANDS NEW AND RECONDITIONED

WE'LL BUY YOUR EXTRA RIG

STATIONS-ESTATES ETC. Call 913/381-5900 FAX 913 648 3020

SEND $2 FOR CATALOG AND WHOLESALE LIST

continued from p. 76

All of us have at least slightly different perspectives on these things.

If you're working on a home-brew project and can't seem to get it to operate quite right, drop a line to the author. There may be a spider or two that got into the article. If you do write, please, by all means, send an SASE for your reply. I know from first-hand experience that those who send an SASE will get a reply quicker than those who don't. In your home-brew project, again, look everything over closely. Be especially picky about the proper pinouts of transistors, ICs, and other active devices. Next, check for the proper polarity of the electrolytic capacitors. Those critters just don't work if they're installed backwards. Look over the values of the resistors. It's so easy to transpose a 1kΩ resistor for a 10kΩ resistor at 2 o'clock in the morning.

To Tweak or Not To Tweak

If you're working on a commercial product, whatever you do, don't get out the diddle sticks and start messing with the alignment! I've never seen a piece of equipment stop working because the alignment went bad, unless someone diddled with it first. Don't diddle unless you really know what you're doing. There is one exception—Heathkit gear. If you can't seem to get one working as it should, then do an alignment. Most Heathkits can be aligned with simple tools, sometimes using nothing but the radio itself. You can sometimes pinpoint trouble by going through the alignment on Heath gear. Finding a stage that will not peak up as it should will give you a starting point for more serious troubleshooting. But again, don't diddle with the alignment of non-Heath gear. We'll look at some more troubleshooting guides later on this year.

". . . most failures occur because of heat."

Ten-Tec Mod

I want to thank all of those who sent me information on converting the Ten-Tec Century 21 for 12 volt operation. For all those who wrote in to me, thanks! For the rest of the gang, here is the modification for 12 volt operation.

First, you'll need a magnetic circuit breaker for the 21. This is Ten-Tec part number 1170. Since the protective circuitry for the PA transistors in the Century 21 is included in the internal power supply, you *must* use the circuit breaker when running the 21 from 12 volts. After you obtain the magnetic breaker, apply 12 volts to the 21 via one of the AUX 12 VDC phono jacks on the rear apron of the Century 21.

Doing this, however, makes the front panel wattmeter inactive (while on external 12 volts only). To adjust for full power, turn up the drive until the breaker trips, reduce the drive a tad, and reset the circuit breaker. You're all set to fly this month for Field Day!

Speaking of Field Day, I sure hope that you guys send in some photos this year. It's been slim input from the QRP operators on the subject of Field Day. Sure could use some good photos. If you like what you see, then by all means drop a line to the editors.

For those of you who just can't get enough solder smoke in your face, I've got some modifications to the Two-Fer. These modifications are by Don Garrett WA9TGT. The mods make for better output filtering, full QSK, automatic antenna switching, high SWR protection, and power output adjustment. The 12 volt line on the oscillator has been moved to the collector of Q4.

This keys the oscillator along with the PA and buffer amplifier. Since there is not enough room this month for the mods, those wishing to get a copy should send me an SASE. I'll send you out two data sheets for the modifications. No SASE, no data!

Don't forget Field Day this month. Watch for openings on ten meters. Should prove to be a lot of fun! 73

ADVERTISERS

Number 27 on your Feedback card

R.S.#	page
279 Ace Communications, CA	45
355 Ace Communications, IN	17
1 Advanced Computer Control	37
65 Advanced Electronic Applications	96*
88 Aerospace Consulting	69
• Amateur Electronics Supply	57*
• American Heart Association	69
314 Ameritron	32
• Ampire, Inc.	47
89 Antennas West	33
304 Antennas West	31
5 Antennas West	68
302 Antennas West	19
90 Antennas West	93
107 Antennas West	47
236 Antennas West	17
303 Antennas West	73
82 Antennex	19
271 Antique Radio Classified	59
• ARRL	93
338 Ashton ITC	17
• Associated Radio	79
16 Astron Corporation	48
• Avcom of VA	43
243 AXM Inc.	59
158 Azimuth Comm.	75
• B & K Computer	33
53 Barker & Williamson	67
41 Barry Electronics Corp.	41
42 Bilal Company	17
• Brian Beezley K6STI	82
156 Buckmaster Publishing	19*
7 Buckmaster Publishing	68*
365 Buckmaster Publishing	45*
• Burghardt Amateur Radio	19
• Butternut Electronics	45
356 C & S Sales Inc.	31
157 Cleveland Institute of Electronics	47
• COMB Direct Marketing	37
343 Commpute Corp.	68
99 Communication Concepts, Inc.	59
121 Communications Electronics	52
10 Communications Specialists	2*
12 Connect Systems	1
306 Creative Control Products	82
147 Data Com International	71
15 Doppler Systems	37
112 E. H. Yost	31
371 Eightland Data	33
• Electron Processing	43*
8 Elktronics	73
• Engineering Consulting	59
324 Epsilon Co.	31
372 G & G Electronics	69
373 Gap Antenna Products	81
339 GGTE	31*
17 GLB Electronics	23
72 Glen Martin Engineering	43
346 Great Circle Maps	13
326 GTI Electronics	68
• Hamtronics, Inc.	77
• Heath Co.	84,85
308 Horizon Manufacturing	79
269 Hustler, Inc.	29*
354 ICOM America	C2*
272 Jun's Electronics	93
• K-40	19
• Kenwood Corp.	7,8,10,C4
23 Larsen Antennas	33
• Maggiore Electronics Lab	55
101 Maxcom Inc.	23*
241 Media Mentors	45*
• Memphis Amateur Electronic	27
114 Metro Printing	69
258 MFJ Enterprises	3
348 Micro Computer Concepts	82
295 Micro Control Specialities	79
• Micro R & D	47
252 Midland Technologies	75
187 Mission Communication & Consulting	36
163 Mobile Mark	55
349 Naval Electronics	59
• N6KW QSLS	47
292 Omar Electronics	68
• P.C. Electronics	55*
152 Pac-Comm	75
178 Pacific Cable Co. Inc	33
68 Periphex	73
378 Protel Technologies	67
34 Ramsey Electronics	64*
347 Reighcon Systems	73
142 RF Enterprises	16
• RF Parts Co.	49*
254 Ross Distributing	68
332 Satellite City	73*
• SCO Electronics	59
73	
• Cumulative Index	69
• Dealers Ad	69
• Subscription Problems?	31
• Uncle Wayne's Bookshelf	62,63
• Silicon Solutions	93
250 Software Systems	69
244 Software Systems	75
183 Spectrum International	36
• Summitek	19
377 Syspec Inc.	31
• The Atlanta Ham Festival	47
• The Ham Station	67
150 The Radio Works	68
115 The RF Connection	93
• Universal Amateur Radio	75
79 Vanguard Labs	33
• VHF Communications	43
191 W & W Associates	23
38 W9INN Antennas	47
319 Wi-Comm Electronics	73
• Wilson Antenna	83
165 Yaesu Electronics Corp.	C3
40 Yaesu Electronics Corp.	15

*Advertisers who have contributed to the National Industry Advisory Committee (NIAC).

u're
Field

sure
ome
n in-
n the
ould
like
eans

can't
your
ions
odi-
rrett
bet-
uto-
high
out-
e on
d to

long
ifier.
oom
nose
send
two
ons.

this
n ten
ot of

card

page
73
16
49*
68
73*
59

69
69
31

62,63
93
69
75
36
19
31
47
67
68
93
75
33
43
23
47
73
83
C3
15
ational

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Ave.
Saugus CA 91350

Barry Goldwater Says YES to No-Code!

"I'll make a prophesy, and I won't be alive to ever see it come true. If we continue to require a knowledge of code for an [amateur] license, people are going to just plain die! I'm 80, and I know I'm not going to be around here forever, and when I'm gone, that's one less guy who knows the code, so what's the difference. I don't want to see amateur radio die out because, as I have said, 98% of all of the improvements made in radio have come out of an amateur's shack. I want to see that encouraged. I think we can swell our ranks by at least 200,000 if we just allow young would-be amateurs to come in as licensed amateurs without having gone through the process of learning Morse Code!"

With these words, former US Senator Barry M. Goldwater K7UGA threw his hat into the amateur radio political arena on the side of those who favor expansion of the amateur service through the introduction of a code-free entry level amateur license. Senator Goldwater made those comments in a videotaped interview record at his Scottsdale, Arizona, ranch on Saturday, February 25, to newsman Roy Neal K6DUE, producer Frosty Oden N6ENV, and Newsline Radio's Bill Pasternak WA6ITF.

Needed: New Blood

During the same session, K7UGA said that he did not think that the amateur community could hold onto the majority of the spectrum it has, particularly at VHF and UHF, without substantial growth. "Can they [the amateurs] hold onto it with the numbers they now have? It's very doubtful. Can you hold onto them with a couple hundred thousand young amateurs? Yes!"

K7UGA went on to give his view that experimentation and building in amateur radio may be a dead issue with many of today's hams, but it can be revived by getting younger people interested in the service: "...We have got to get some new blood. We have to get the new ones who will sit down with a screwdriver and soldering iron and a manual, and build something. When they [younger hams] hear of some new method of communications, they [will] sound like they know something about it... You ask the average ham our age–or my age, because I'm a hell of a lot older then you–to describe some of these new signals, and they can't do it."

Partly Politics

Senator Goldwater says that the American Radio Relay League, publications, and industry, must take an active roll in leading amateur radio to new times through a no-code amateur license: "...you first have to get the ARRL behind it. You have to get these magazine editors–who I think are inclining that way. And [talking to the amateur radio industry] you have got to remember one thing, if you have more amateurs, you are going to sell more equipment.

"You have the same problem in anything that touches on politics...The easiest way [to grow] is to convince the American Radio Relay League that, opposition or no opposition, if they want to increase the amateur ranks, they have to do away with the number one objection—code."

Pass it Along

The complete program was uplinked to the WESTSTAR 5 Communications Satellite (122.5 Degrees West) on Sunday afternoon, March 12 at 3 PM Eastern/Noon Pacific. It appeared on transponder 1D (1 Direct—Horizontal Polarization). Amateurs with satellite receivers and VCRs who recorded the program are encouraged to replay it at their regular club meetings, and use it to help formulate their opinion on these issues. As no music was on the presentation, it's suitable for live or delayed retransmission on ATV systems. You can also replay the audio on your local repeater. *Newsline Radio* and the *BEAR Information Service* provided the audio portion of the Goldwater conference by dial-in telephone after it aired. 73

Barry Goldwater K7UGA, an elder statesman of amateur radio and veteran CW op, during his statement of support for a no-code entry-level license.

Round-trip to Europe* on G.A.P. Airwaves for only $169.00

Introducing
THE CHALLENGER DX-V

A Unique Multiband Antenna that Utilizes the Patented G.A.P. Center Launch Technology

The Revolution in Antenna Design

That...
- Operates all five bands 80-40-20-15-10m
- Provides RF from an elevated G.A.P.
- Provides 1500 W peak operation
- Assembles in less than 30 minutes
- Comes pre-tuned. No adjustments are necessary
- Has short Radials 8.5m 25' & 4.5m 15'
- Is self-standing with 3 drop-in Ground Mount
- Is only 31 Feet high
- Has a Bandwidth (less 2:1) 80 MTR 150 KHZ 40-20-15-10 MTR Total Band
*Three portions of 80m band available
Low – CW Normally 3.8 mHz
Mid – CW Normally 3.8 mHz
Top – CW Normally 3.9 mHz

but has NO!!!
- Traps
- Coils
- Transformers
- Baluns
- Resistors
- or Base Insulators

*also Asia, South America, North America, Australia, Africa and Antarctica.

Best of all the ENTIRE antenna is always active!!

To Order Call—(407) 388-2905
VISA $169.00 plus shipping & handling
Florida residents add 6% tax

G.A.P. ANTENNA PRODUCTS
6010-Bldg 2
N. Old Dixie Highway
Vero Beach, FL 32967

CIRCLE 373 ON READER SERVICE CARD

73 Review *by Marc Stern N1BLH*

Wilson 1000 Mobile Antenna

Get into some 10m mobile QRO with this whip.

Wilson Antenna
2 Commerce Center
Henderson NV 89014
(800) 541-6116
Price Class: $90

Now that we are nearing the peak of what promises to be the best solar activity in history, many operators are discovering the fun of the 10 meter band. It's a band which combines the attributes of HF and VHF, and offers lots of prime DX. With such recommendations, is it any wonder that 10 meter rigs are selling like hot cakes, and that Novices are on the air using their phone privileges?

10 Meter Antennas

One of the more interesting aspects of 10 meters is the antenna. There are so many possibilities that it can boggle your mind. For example, you can convert a 109-inch CB whip to 10 meters (11 meter CB to 10 meter Ham), you can convert one of the many magnetic-mount or shortened 10 meter antennas, or you can buy a 10 meter antenna made specifically for the band.

One of the better 10 meter antennas that we've found lately is the new Wilson 1000. Wilson, long a manufacturer of quality communications antennas, is a name that many will remember fondly as one of the pioneering firms in VHF communications. Although Wilson has been out of the radio manufacturing business for a few years, it has remained in the antenna business. The firm's long experience shows up in the 1000.

For starters, it just doesn't look like other 10 meter antennas on the market. Maybe it's the big base loading coil, or the 60-inch-plus tapered 17-7 steel radiator or, maybe, it's the PL-259 connector in the base of the antenna. Who knows? All we do know is that the antenna works very well. In a comparison test with the American Antenna HAM-10, we found that the 1000 performed as well as or better than the HAM-10, and was far less prone to noise pickup. (The test setup was: a clear parking lot; our car; Uniden HR-2510 and Clear Channel AR-3500; and a field-strength meter.) Using an attenuator, we cranked the power back to about one Watt and tested the antennas. The results were interesting—the Wilson performed better, especially toward the lower end of the band.

That is one of the interesting points about the Wilson 1000: It arrives set up to work in the lower end of the band. We still found the VSWR too high for our liking, and trimmed the radiator about 5 inches to make sure that the antenna was resonant. It is fairly flat across the entire band, although the VSWR does climb at the high end, near 29.600 MHz.

On the air, QSOs confirm the point that the Wilson 1000 is a fine performer, on a par with full quarter-wave mobile whips. It is a loaded antenna, which effectively increases the Q of the antenna circuit and limits its bandwidth.

To keep these losses to a minimum, Wilson uses quality constructions techniques, including a wide base loading coil that is made out of 10 gauge, silver-plated wire. The tap point is determined by a computer. The antenna is made of a quality, high impact plastic, and the connectors are standard PL-259/SO-239, which should assure a tight fit and years of use.

Remember, if you are thinking of this antenna, that such quality construction doesn't come cheap. At $89.95, the Wilson 1000 is not inexpensive. However, given its construction and performance, it's a purchase worth considering.

ANTENNA ANALYSIS

The new MN program will analyze almost any antenna made of wire or tubing. Compute forward gain, F/B, beamwidth, sidelobes, current, impedance, SWR, near-fields, and far-fields, in free space or over realistically-modeled earth. Plot antenna radiation patterns on your graphics screen. MN can compute the interaction among several nearby antennas. The 5-1/4" MN disk contains over 100 files, including libraries of antenna and plot files, a file editor, and extensive documentation. MN is an enhanced, easy-to-use version of MININEC for IBM-PC. $75 ($80 CA & foreign).

YAGI OPTIMIZER

The remarkable new YO program *automatically* adjusts Yagi element lengths and spacings to maximize forward gain, optimize pattern, and minimize SWR. Radiation patterns at band center and edges are updated on your screen during optimization. YO is extremely fast, computing several trial Yagi designs *per second* with 8087. YO is a complete Yagi design package for IBM-PC, containing models for gamma and hairpin matches, element tapering, mounting plates, and frequency scaling. A library of Yagi files and extensive documentation are included. $90 ($95 CA & foreign).

To order, send a check to:
Brian Beezley, K6STI, 507-1/2 Taylor LN., Vista, CA 92084

RC-1000 REPEATER CONTROLLER | From Micro Computer Concepts

- Complete RX-TX-Phone Line Interface
- Repeater Control
- Autopatch
- CW ID
- Tailbeeps
- Remote Base/Tape
- 12 V AC/DC Oper.
- Reverse Patch
- DTMF Decoder
- Pulse/Tone Dialing
- 90 Day Warranty

Wired & Tested w/manual ...$219.95

Distributed by:
R & L Electronics
575 Main St. / Hamilton, OH 45013
1-800-221-7735
in Ohio 513-868-6399
MasterCard VISA

CIRCLE 348 ON READER SERVICE CARD

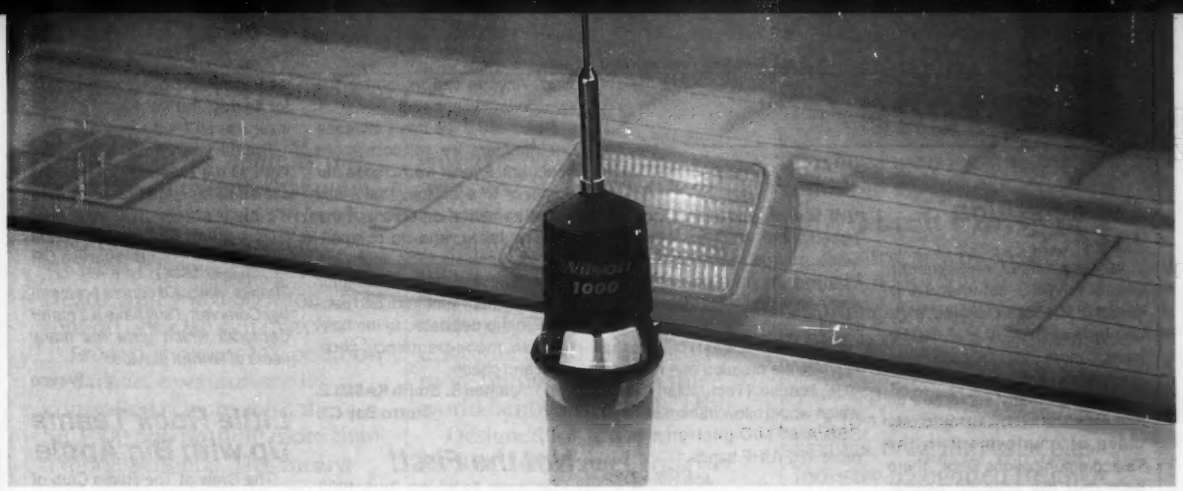
SRC-10 REPEATER/LINK CONTROLLER

DTMF muting
Intelligent ID'er
Auxiliary outputs
Easy to interface
Alarm monitor input
Telemetry response tones
Low power CMOS, 22ma @ 12v
Detailed application manual
Programmable COS polarities
Repeater & link courtesy tones
Synthesized link/remote base capability

$149.00 *Assembled & Tested*

CREATIVE CONTROL PRODUCTS
3185 Bunting Avenue
Grand Junction, CO 81504
(303) 434-9405

CIRCLE 306 ON READER SERVICE CARD



World's Most Powerful CB and Amateur Mobile Antenna*

Lockheed Corp. Test Shows *Wilson 1000* CB Antenna Has 58% More Gain Than The K40 Antenna (on channel 40).

In tests conducted by Lockheed Corporation, one of the world's largest Aerospace Companies, at their Rye Canyon Laboratory and Antenna Test Range, the Wilson 1000 was found to have 58% more power gain than the K40 Electronics Company, K40 CB Antenna. This means that the Wilson 1000 gives you 58% more gain on both transmit and receive. Now you can instantly increase your operating range by using a Wilson 1000.

Lockheed - California Company
Plant 2 Bldg. 150 Dept. 74-76
A Division of Lockheed Corporation
Burbank California 91520

Aug. 21, 1987

Wilson Antenna Company Inc.
3 Sunset Way Unit A-10
Green Valley Commerce Center
Henderson, Nevada 89015

Subject: Comparitive Gain Testing of Citizen's Band Antennas
Ref: Rye Canyon Antenna Lab File #870529

We have completed relative gain measurements of your model 1000 antenna using the K-40 antenna as the reference. The test was conducted with the antennas mounted on a 16' ground plane with a seperation of greater than 300' between the transmit and test antennas. The antennas were tuned by the standard VSWR method. The results of the test are tabulated below:

FREQUENCY(MHZ)	RELATIVE GAIN(dB)	RELATIVE POWER GAIN(%)
26.965	1.30	35
27.015	1.30	35
27.065	1.45	40
27.115	1.60	45
27.165	1.50	41
27.215	1.60	45
27.265	1.75	50
27.315	1.95	57
27.365	2.00	58
27.405	2.00	58

58% MORE POWER GAIN THAN THE K40

A complete description of this test is contained in file #870529. Excerpts of this report are enclosed.

Louis Wilson, Antenna Engineer
Electromagnetics Laboratory

Approved:
W. C. Weikel, Group Engineer
Antenna/ATS Support Laboratory

Guaranteed To Transmit and Receive Farther Than Other Mobile CB Antenna or Your Money Back**

New Design

The Wilson 1000 higher gain performance is a result of new design developments that bring you the most powerful CB base loaded antenna available.

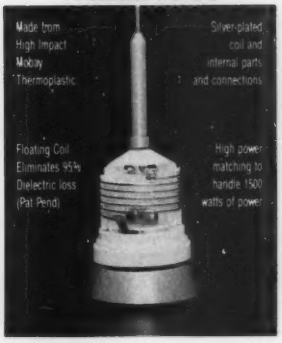
Why Wilson 1000 Performs Better

Many CB antennas lose more than 50% of the power put into them. The power is wasted as heat loss in the plastic inside the coil form and not radiated as radio waves.

We have designed a new coil form which suspends the coil in air and still retains the rigidity needed for support. This new design eliminates 95% of the dielectric losses. We feel that this new design is so unique that we have filed a patent application on it.

In addition, we use 10 Ga. silver plated wire to reduce resistive losses to a minimum.

INTERNAL VIEW
Wilson 1000


Made from High Impact Mobay Thermoplastic
Silver-plated coil and internal parts and connections
Floating Coil Eliminates 95% Dielectric loss (Pat Pend)
High power matching to handle 1500 watts of power

FREQUENCY RANGE 26.9 to 28.5

In order to handle higher power for amateur use, we used the more efficient direct coupling method of matching, rather than the lossy capacitor coupling. With this method the Wilson 1000 will handle 1500 watts of power.

The Best You Can Buy

So far you have read about why the Wilson 1000 performs better, but it is also one of the most rugged antennas you can buy. It is made from high impact thermoplastics with ultraviolet protection. The threaded body mount and coil threads are stainless steel; the whip is tapered 17-7 ph. stainless steel. All of these reasons are why it is the best CB antenna on the market today, and we guarantee to you that it will outperform any CB antenna (K40, Formula 1, you name it) or your money back!

CALL TODAY

TOLL FREE: 1-800-541-6116
FOR YOUR NEAREST DEALER

Wilson 1000

Available in Black or White

Trunk & Roof Mount **79.95**
Magnetic Mount **89.95**
***Wilson 1000* Trucker** **59.95**

DEALERS
Exclusive dealer areas still open

Wilson
ANTENNA INC.
#2 COMMERCE CENTER
HENDERSON, NV 89015

* Inductively loaded antennas
** Call for details.

LETTERS

From the Hamshack

Let's Petition the FCC

At my place of employment, where an FCC commercial license (2nd Class/General) is required, less than 10 in a department of more than 200 employees are licensed amateur radio operators, though many expressed an interest in the hobby. At my former place of employment in the Telecommunications Dept., there were only two licensed people, though again, many were interested in ham radio. Why, in a nation with millions of electronic technicians, engineers, and computer hobbyists, are so few willing to go even for Novice?

The nail in the coffin is the code requirement. If anyone is to be blamed for the lack of public interest in amateur radio, the blame must rest on the ARRL. It has been spoon-feeding its members the propaganda that if the FCC created a no-code license, the ham bands would end up like CB. But many nations do not require code in order to obtain a VHF/UHF license, and this has not happened there. In these other nations, a large percentage of the licensed amateur operators are engineers and electronic technicians.

I propose that we (1) petition the FCC for the creation of a no-code VHF license (Technician class) which would allow transmission of SSB/AM/FM/Digital on one or more VHF/UHF bands.

Joe Hill KO7P
S. Pasadena CA

Joe, thoughtful no-code license petitions are already appearing at the FCC's doorstep. See the first item in QRX for a summary of one of these. . . NS1B

Yes to Code

I'm writing in response to all of the articles on no-code. In my opinion there should be a code requirement in all cases. Some say the code test is too narrow of a filter. I believe on the other hand the written test is too wide of a filter. Anyone can memorize the questions and answers.

Some say if we don't increase our numbers we will lose more spectrum. Even if we increase our numbers to a million, that's still less than half of a percent of the US population, and no competition for back-slapping lobbyists and corrupt politicians. I'd rather have minimum spectrum and people who are dedicated to the hobby than mega-frequency allotment and chaos.

James S. Smith KA6MLE
Morro Bay CA

Not the First!

On page 24 of the April 1989 issue of *73*, you ran a picture of the Kenwood TM-621A with the caption "...The world's first 2m/220 MHz dual band mobile rig in a single box. . . ." This is incorrect!

In 1975 I worked as a circuit board assembler for Comcraft Corporation of Goleta, California, building the Comcraft CST-50. The CST-50 was a 2m/220 mobile, digitally-frequency-synthesized single box, designed by Jack Dickenson N6PI and Len Surrette of the Santa Barbara area.

I built them, and years later when I got my ticket, I made my first contact on one. The CST-50 was a miracle of miniaturization for its day; the frequency synthesizer was all 7400-series TTL.

I hope you'll set this straight. With all the America-bashing, we should at least give credit where it's due.

Jeff Berkowitz N6QOM
Beaverton OR

Thanks, Jess. Of course I remember Comcraft. I still have a 2 meter Comcraft which gave me many years of faithful service.

. . . Wayne

Little Rock Teams Up with Big Apple

The Crew at The Radio Club of Junior High 22 in New York City, a nonprofit organization using ham radio in education, has more than 200 teenagers on 15 and 40 meters every school day for at least eight hours. There are bound to be some interesting contacts.

Thanks to Bill McClintock K5SGG, Governor Bill Clinton of Arkansas, is now on the long list of supporters who believe in ham radio as a teaching tool. Bill the ham began working with the Crew in the fall of 1988. He introduced the students to Arkansas via countless QSOs on 21.395, their morning and evening frequency. As the term progressed, more and more Arkansas hams joined in, each bringing a view of life in a state many kids never heard of before.

Near mid-term, with increasing check-ins from newly admitted Arkansas operators, Bill the ham decided to go to the top. Bill the governor should know just what a tremendous educational service his fellow resident hams were providing to the children living on the lower east side of Manhattan.

Bill the governor was impressed. He delivered a letter of support and a full-size state flag, which had flown over the capitol of Little Rock, to the Radio Club of JHS 22. It is permanently on display in the classroom housing the main station and home of "Education Thru Communication."

Arkansas hams involved in education have been in contact with Joe Fairclough WB2JKJ, the executive director of Radio Club 22. Since the program works so well in New York City, and at other sites around the country, perhaps the children of Arkansas will be the next to reap the benefits of "Education Thru Communication." All this from a simple QSO on 21.395 MHz.

Joseph J. Fairclough WB2JKJ
New York NY

Now receive or leave messages with other local hams using the 16K Bulletin Board featured on the smallest TNC available – the Heath® HK-21 Pocket Packet.

The BBS operates under your call with simple commands like Send or Write a message, Kill a message and read the File messages currently on the system. And the HK-21 Pocket Packet is fully TNC-2 compatible.

Hookup is easy. Plug in supplied cables instantly to most HT's, or wire a separate cable into your mobile or base VHF or UHF rig. Connect your computer via RS-232 and you're ready to call a fast-growing number of packet hams.

The HK-21 Pocket Packet requires only a single 12 VDC @ 40mA power source or as little as 29mA from an optional HKA-21-1, internally mounted 4.8 volt, 120 mAh, NICAD battery.

The Heath® HK-21 Pocket Packet – $219.95 (Amateur net price)
To order, call 1-800-253-0570

Get your message across... even when no one is listening.

For information on Heath's complete line of amateur radio products call 1-800-44-HEATH for your FREE Heathkit® catalog.

Best to start with.
Best to stay with.
Heath Company
Benton Harbor, MI 49022

A subsidiary of Zenith Electronics Corporation
©1989 Heath Company

Top performance for less than 80 cents a watt

DX-ing, contests, pile-ups, traffic handling. When you need to command attention, you will with the SB-1000 Linear Amplifier from Heath. And you'll do it for a cost that no one else can match.

From our recent DX-pedition to Taiwan, operators easily controlled pileups with the SB-1000 and nothing more than a dipole antenna. This means that when conditions are tough, you know you can depend on your SB-1000 to lift your signal above the rest. Whether you're using a dipole or stacked monoband beams.

Proven output power

We don't play games by using old rating methods to make you pay for input power you don't get at the antenna. What you do get is 1000 watt output of peak envelope power on SSB and 850 watts on CW. Even 500 watt output on RTTY.

On the chance that someone might doubt our claims, at hamfests we demonstrate that with only 80 to 100 watts of drive, our SB-1000 develops more output than even the world-famous Heath SB-220!

Designed for today, the SB-1000 offers quiet, compact tabletop operation at rated output. That's only 1.7dB (or about ⅓ of an S-unit) below the maximum legal power limit.

"I built it myself!"

Because you build the Heathkit SB-1000 Linear Amplifier yourself, you not only enjoy cost savings, you have the unique opportunity of knowing your equipment inside and out.

A top quality amplifier, cost savings, bragging rights, plus industry-recognized Heathkit manuals and technical assistance from our licensed ham consultants, should you ever need it. An offer that's hard to pass up.

See the SB-1000 and our complete line of amateur radio products in the Spring Heathkit Catalog. Call today for your free copy.

1-800-44-HEATH
(1-800-444-3284)

Best to start with.
Best to stay with.

Heath Company
Benton Harbor, Michigan 49022

© 1989, Heath Company. Heathkit is a registered trademark of Heath Company. A subsidiary of Zenith Electronics Corporation.

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

At last! See box for the ***list of current Hambassadors,*** *in alphabetical order by country. Where only a country is listed, we have a vacancy; countries not listed at all have never had a Hambassador, and we will welcome volunteers. (Preference will be given to nationals of a country; please give years and experience as a ham.)*

Esperantist hams note: *Major S. N. Rai Deb Barma (Retired), Krishnaloy, Vivekananda Sarani, Narendrapur–743 508, West Bengal, India, expresses interest in the International League of Amateur Radio Esperantists (see June, 1988, issue, p.90, col. 4, and the July issue, p.91, col. 1).*

Roundup

Country of the Month: France. What tallest structure in the world (then) celebrates its centennial this year and was saved from being torn down by The Unknown Ham?

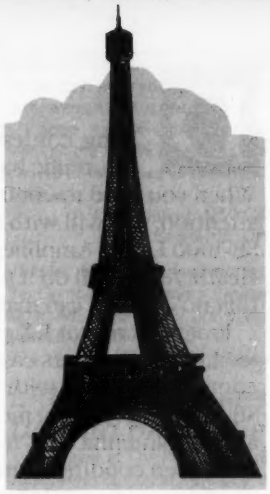
Well, sort of: When radio was invented, what was virtually the world's longest-range antenna was placed atop the structure. Then in 1914, thanks to the antenna, a secret message was picked up telling of an impending attack on the city in which this structure was built, and troops were moved into position in time for a famous battle. That ended all thought of demolition.

The structure was the Eiffel Tower, of course, the city was Paris, and the battle was of the Marne. The tower was built for a world exhibition and was not intended to be permanent—which was fine by its critics, one of whom called it a "hollow candlestick," and another, an "arrogant piece of ironwork."

It is a tourist landmark, and in honor of its birthday on May 15, tourists and the world will be seeing the first of many 1989 spectacles. One hundred giant lights will be turned on around the city and 100 giant balloons, 20' in diameter, will be launched to form a 15-mile ring around the tower. Fireworks will blaze into the sky, and the official birthday message is an exhortation "to make universal communication the great adventure of the 21st century."

The tower will be an "electronic Tower of Babel" for the rest of 1989, with a "World Channel" broadcasting radio and TV to every nation, in many languages, by satellite 24 hours a day. (From a story by John Njor, in *Politiken*, Copenhagen, reprinted in *World Press Review.*)

[In 1944, the RP part of CCC, then in the US Army Signal Corps which was using the tower, went to its topmost level, planning to climb the vertical ladder and then stick a hand higher than the tip. When he got up there he had no trouble changing his mind! Rereading a wartime letter home many years later, however, he found he had jokingly predicted he'd probably claim he did it, anyway. Embarrassing, because af-



CALENDAR FOR JUNE

1—Children's Day, China; National Day, Tunisia (7th for Chad, 25th for Mozambique).
2—Anniversary of the Republic, Italy; Coronation Day, Great Britain.
3—Labor Day, Bahamas.
5—Constitution Day, Denmark; Liberation Day, Seychelles; Bank Holiday, Ireland; Queen's Birthday, New Zealand (10th for Great Britain).
6—Memorial Day, South Korea; National Holiday, Sweden (10th for Portugal, 23rd for Luxembourg).
7—Independence Day, Norway (12th for Philippines, 26th for Madagascar and Somalia, 29th for Seychelles). *We asked this question a couple of years ago—and nobody took the bait. We're trying again: Liberation Day for the Seychelles was on the third. Independence Day on the 29th. What could the status of these 86 islands and its (now 67,000) people have been between June 5 (liberation) and June 29 (independence)?—CCC*
13—Corrective Movement Day, Yemen.
14—Flag Day, USA (20th for Argentina).
17—Republic Day, Iceland; Commemoration Day, West Germany.
18—Evacuation Day, Egypt; Father's Day, USA.
19—Revolution Day, Algeria.
22—National Sovereignty Day, Haiti.
24—Peasants Day, Peru; Kings Day, Spain; St. Jean Baptiste Day, Canada.

73 INTERNATIONAL HAMBASSADORS

Argentina
Australia—Ken Gott VK3AJU, 38A Lansdowne Rd., St. Kilda, Victoria 3183
Austria
Bahrain—Ian Cable A92BW, POB 22381, Muharraq
Bangladesh Belgium
Brazil—Gerson Rissin PY1APS, POB 12178, Copacabana, 20000 Rio de Janeiro, RJ; Carlos Vianna Carneiro PY1CC, Afonso Pena, 49/701, 20270 Rio de Janeiro
British West Indies (See United Kingdom)
Canada Chile
Canary Islands (See Spain)
China (People's Republic of)—Chang Han Dong (BY4ACM), Inst. of Estuarine & Coastal Research, East China Normal Univ., Shanghai 200062
Colombia Costa Rica Cuba
Cyprus—Aris Kaponides 5B4JE, POB 1723, Limassol
Czechoslovakia—Rudolf (Rudy) Karaba OK3CMZ, Gogol'ova 1882, 955 01 Topol'cany
Denmark Dominican Republic Ecuador El Salvador Finland France
Germany (Federal Republic of)(West)—Ralf Beyer DJ3NW, Opferkamp 14, 3300 Braunschweig
Great Britain (See United Kingdom)
Greece—Manos Darkadakis SV1IW, POB 23051, 11210 Athens
Hong Kong, Crown Colony of (See United Kingdom)
India Indonesia Iraq Ireland
Israel—Ron Gang 4X1MK, Kibbutz Urim, D.N. Hanegev 85530
Italy—Mario Ambrosi I2MQP, via Stradella 13, 21029 Milano
Japan (The Japan Amateur Radio League, Inc., Shozo Hara JA1AN, President, sends its regular publication to 73 International.)
Jordan
Kenya—Rod Hallen 5Z4BH, Box 98, APO New York 09675
Korea (Republic of)(South)—Byong-joo Cho HL5AP, POB 4, Haeundae, Pusan
Liberia Liechtenstein Malaysia Malta Mexico Mozambique Nepal
Netherlands (Kingdom of)—Joseph A. Stierhout PA0VDZ, POB 285, 6950 AG Dieren
New Zealand—Des Chapman ZL2VR, 459 Kennedy Rd., Napier
Norfolk Island—Kirsti Jenkins-Smith VK9NL, POB 90, Norfolk Island, 2899 Australia
Norway Panama Papua New Guinea Peru
Philippines—Leo M. Almazon WA6LOS/DU, 10098 Knight Drive, San Diego CA 92126
Poland—Jerzy Szymczak, 78-200 Bialogard, Buczka 2/3
Portugal—Luiz Miguel de Sousa CT4UE, POB 32, S. Joao do Estoril, 2765
Russia (See United Soviet Socialist Republics)
San Marino (Represented by Italy at this time)
Saudi Arabia
South Africa (Republic of)—Peter Strauss ZS6ET, POB 35461, Northcliff, ZA–2115
Spain—(Represented at this time by the Canary Islands Hambassador): Woodson Gannaway N5KVB/EA, Apartado 11, 35450 Santa Maria de Guia, (Las Palmas de Gran Canaria), Islas Canarias, Spain
Sri Lanka
Sweden—Rune Wande SM6COP, Frejavagen 10, S–155 00 Nykvarn
Switzerland
Taiwan (Republic of China)—Tim S.H. Chen BV2A/2B, POB 30–547, Taipei, Taiwan 107
Thailand—Tony Waltham HS1AMH,POB 2008, Bangkok
Togo Trinidad and Tobago (Republic of)
USSR—Gennady Kolmakov UA9MA, POB 341, Omsk - 99
Venezuela Vanuatu (Republic of) Yugoslavia Zambia
Zimbabwe—Bernard C. Herring Z21EI, POB 2234, Bulawayo
United Kingdom
British West Indies—Errol Martin VP2MO, Box 113 Plymouth, Monserrat BWI, Leeward Islands Zone 8
Great Britain—Jeff Maynard G4EJA, 32 Waldorf Heights, Hawley Hill, Camberley GU17 9JQ, England
Hong Kong—Phil Weaver VS6CT, POB 12727

ter the war he really did "remember" he did it and probably had said so many times. Today he claims he has told only that one lie in his whole life. Oh? Right there is at least his third one....—CCC]

Malta. C.A. Fenech 9H1AQ (35, Main St., Attard, Malta) sends us the requirements for being a ham in the Republic of Malta. Apply to The Chief Inspector of Wireless Telegraphy, Wireless Telegraphy Branch, Auberge de Castille, Valletta, Malta. Fee (do not send until requested): 3 Maltese pounds (approx US$8). If you use the 73 International form (see last month's issue) provide this additional information: (1) Proof of Morse speed dated no more than one year before your application. (Required: 36 words averaging five letters long per three minutes sending, the same for receiving, with no more than four uncorrected errors; and 10 five-figure groups in 1-1/2 minutes, sending or receiving, no more than two uncorrected errors permitted. (2) Details of your occupation. (3) Home telephone number. (4) Mother's and father's names. (5) Circuit diagram of transmitter(s).

South America. The Brazilian magazine, *Electronica Popular* (Caixa Postal 1131, 20000 Rio de Janeiro, RJ, Brazil), sends us the following about its awards.

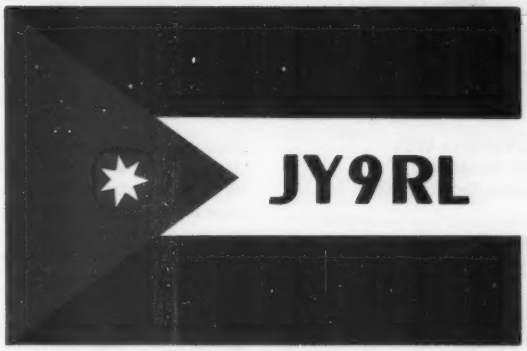
The EP-AA (sponsored by the magazine's Amateur Radio department, "CQ-Radioamadores"). Contact after March 31, 1967 with 60 countries bordering the Atlantic Ocean including one Brazilian oceanic island (PY0). DXCC list countries only, and only Atlantic border countries—not of interior seas like the Mediterranean. All authorized amateur bands and transmission types with minimum report of 3-3 for phone and 3-3-8 for CW. Send log authenticated by a recognized amateur radio association and five IRCs (only IRCs, please!) to EP-AA Manager at above address.

Worked All PY Award (WAPY), sponsored by the magazine's Antenna Editorial Group. One confirmed two-way contact on or after May 15, 1981 (EP's 25th anniversary), any band, any mode with each of the nine continental PY call areas (PY1 to PY9; NOT valid are PP, PR, PS, PT, etc.). The award is issued to the amateur, not the callsign, but contacts must be made from the same call area if any, or same state or county. Send GCR list (no QSL cards) showing full details of QSLs, certified by a recognized amateur radio society. No fee for non-Brazilians, but it is suggested that 5 IRCs would be helpful to help cover costs. Send to the Antenna Editorial Group at above address.

Sweden. DXers who don't know about Radio Sweden (are there any?) should send for information (address S-10510 Stockholm, Sweden). Radio Sweden publishes a weekly *Sweden Calling DXers* bulletin, and "Listeners who send in media news go on the mailing list for one year." Send tips to George Wood at Swedish telex 11738, Telefax +46-8-667-6283, to CompuServe (Easyplex 70247,3516), through the FidoNet system (to 2:501/297, or to SM0IIN on the packet radio BBS SK0TM. A recent issue carried two-to-eight-line news items on broadcasts from 17 nations; the next (#2018 if you want it) listed publications available such as their own *Beginners Guide to DXing, Communications in Space-The DXers Guide to the Galaxy, The DXers Guide to Computing,* the first two free, the third for US$3 (GBP2, FF20, SEK20, DM7, or 7 IRCs).

Other titles listed, some evaluated, included *Passport to World Band Radio, World Radio TV Handbook, International Listening Guide, Ninety-Nine Nights on Medium Wave, Guide to Utility Stations, The Soviet Maritime Radioteletype Dictionary,* and other publications.

UK (Scotland). John McGill GM3MTH (Paddy) writes of awards by the Scottish Tourist Board (Radio Amateur) Expedition Group (PO Box 59, Hamilton, Scotland ML36QB). The Thistle Award is for contacting four separate STB events and the Supreme Tartan Banner Award for contacting a further two stations for a total of six. The first must be claimed first, separately, by sending QSLs or log extracts and US$2, 1 pound, or equivalent. For the second, send proof and US$3, 1 pound 50 or equivalent. Annotations awarded free for a further 2/4/6 etc. events. Available to SWLs on a heard basis. Address Awards Manager Robbie GM4UQG at above address.



Alan Kaul W6RCL submitted this for QSL card of the month—it came in second place—and is awarded the honor of being printed here! (Only overseas cards eligible.)

NORFOLK ISLAND POPULATION ZOOMS TO ADDITIONAL PERSON PER TWO SQUARE MILES

[*Only temporarily, thank goodness! By now it should be back to its comfortable ±135 for each of its 13.5 square miles! We enjoy the placid-pace-of-life feeling we get while reading Kirsti's reports. "...the sea and the sky were both blue, and the Island was invitingly green...." Ahh! So sit back, heave a deep sigh, relax, and read the following at the rate of 100 wpm!—CCC*]

The end of 1988 saw quite an influx of visiting amateurs to Norfolk Island, combining a little operating with pleasure.

Mine JH1LKH arrived in October after a stopover on Lord Howe Island (VK9L), halfway between Sydney, Australia, and Norfolk Island, and the only land to be sighted over that stretch of water.

Mine operated as VK9NQ from Norfolk Island for a week, but did not devote all his time to the bands. He managed to make about 1,000 QSLs, mostly on CW. But the sea and the sky were both blue, and the Island was invitingly green after the winter rains and there was sight-seeing to be done.

Following on Mine's heels came Pete W6ZH, equipped with his truly portable home-brewed CW 20m rig. Pete and his wife, Meredith, spent most of their time exploring the Island, but in the late evenings Pete would come up on 20m CW as VK6BCW/VK9N. (Quite a mouthful! The VK6 call was due to Perth, in Western Australia, being his first landfall in Australia.)

No sooner had Pete and Meredith departed for New Zealand than Kari VR6KY arrived. She had been in New Zealand with her daughter, and as there was still time to wait for the next ship to Pitcairn, they came here to visit friends and relatives. Kari had most certainly not come to operate DX! That would be a busman's holiday. And after a few weeks of visiting, swimming, sightseeing and so on, they left in time to be home for Christmas.

During this busy period of visitors, JOTA took place on the amateur bands, and the Scouts and Guides, who have been active here for decades, participated. Bob VK9ND acted as host to some 20 girls and boys, under the supervision of their scoutmaster. They talked with other young people in Australia and on some of the Pacific islands. (Propagation and time limitations prevented chats with the USA and Europe.)

Direct shipping service to Australia has been withdrawn, and mail goes aboard infrequently-arriving ships which then travel via Fiji and goodness knows where else. The Post Office accepts no responsibility for the resulting delays.

Remember that one IRC pays for such surface mail ONLY! QSL cards are not accepted as valid for the "greeting card" rate. And postal rates are up. Air mail to the USA is now $1.00 and to Europe and South America, $1.10.

Be patient!

de Kirsti Jenkins-Smith VK9NL

"What famous structure . . . was saved from being torn down by The Unknown Ham?"

Hams Around the World

Chod Harris VP2ML
PO Box 4881
Santa Rosa, CA 95402

Antoine Baldeck F6FNU Controversial QSL Manager

The February, 1989, issue of *Radio*, the official publication of the Reseau des Emetteurs Francais (REF, the French equivalent of the ARRL), contains a notice that QSL cards coming from QSL manager F6FNU will not be accepted for any REF award after March 1, 1989. The International DX Association has severed all ties with F6FNU and asked him to stop putting the INDEXA logo on his QSL cards. And the ARRL has sent a letter to F6FNU concerning his controversial QSL practices.

These steps are particularly significant because Antoine Baldeck F6FNU handles QSLs for about 150 stations, including some very active DX stations and some stations in otherwise rare countries. Among the stations for which F6FNU handles cards are: FR/G/FH4EC, FT0WA, TR8SA, 6W6JX, 5R8JD, 5T5NU, FR4FA, 3B9FR, and many more, mostly French overseas operators. Antoine is a 56-year-old grandfather, of Eastern European descent. He is a retired engineer from the French power company and enjoys an 85% pension.

Investigation Begins

What has led to the above unprecedented actions? To find out, I launched a comprehensive, six-month investigation into Antoine Baldeck F6FNU and his QSL management. I received hundreds of pages of material on F6FNU, from hundreds of DXers around the world, much of it from Pierre Essinger F6HIZ (director of INDEXA), and from F6FNU himself.

The controversy surrounding F6FNU's QSL management began early in 1986, when Antoine sent a letter to the French DX newsletter *Les Nouvelles DX* (*LNDX*) stating that French hams who wanted a direct QSL card from Antoine are requested to add one International Reply Coupon (IRC) or an additional stamp to their self-addressed, stamped envelope (SASE), or F6FNU would answer via the bureau. (This would be equivalent to a stateside manager such as W3HNK refusing to answer directly a QSL request with a self-addressed envelope with a $0.25 stamp!) In other words, F6FNU asked for money over and above the cost of return postage for a direct QSL.

French amateurs were incensed by this requirement for a "tip" in addition to postage, an unprecedented practice. F6AJA, editor of *LNDX*, published an editorial against the demand for funds in addition to adequate return postage. F6EYS, president of the Clipperton DX Club, wrote Antoine:

"I believe that a manager who cannot break even (including mailing, printing, etc.) is badly organized. If one wants to make a profit, the explanation is different. He believes he is engaged in a trade, he becomes a commercial manager."

Antoine was quick to defend his practice of requiring additional funds from French DXers. He cited the expense of printing the cards, forwarding cards to distant stations, and helping with customs duties, spare parts, etc., all legitimate expenses for a QSL manager.

However, three separate letters from F6FNU cite another reason for the demand for additional funds. In a letter to F6AJA, one of the reasons given is "the hours spent." In a letter included with some QSLs, he says, "The extensive mail, the time I am spending to help them . . . is not for free . . . QSLing takes 5 hours per day." And in a letter to me, Antoine says, "I spent a lot of time and money on various stations." These statements from F6FNU could lead the DXer to think that Antoine expects payment for the time spent on QSL chores.

Beyond France

For some time, F6FNU's insistence on funds in addition to postage affected only French DXers. But the problem soon began to impact DXers around the world. For example, one US DXer sent two IRCs with each of two QSL requests to F6FNU. Although two IRCs are sufficient for airmail return to the US, Antoine returned the cards via "Imprime Air Mail," at a cost of 3.2 French francs (about $0.50), a tidy profit. Another stateside DXer sent three separate self-addressed envelopes with adequate French postage for airmail return. A card came back via the bureau. Antoine apparently kept the postage. Another US DXer sent four US$1 and two IRCs for five QSLs. He received one back via the bureau, another via Imprime mail, for a postage cost to F6FNU of $0.50. A very prominent DXer sent F6FNU three SAEs with three IRCs each and received his card back without postage via a package sent bulk to me! A local DXer has spent $20 trying unsuccessfully to get a card from Antoine. The cards arrived only after F6FNU was chastised for his QSL practices.

An SWL sent Antoine 10 cards with 6.3 FFrs and an IRC. Antoine cut the stamps off the envelope and returned the cards printed matter rate for only 3 FFrs, a profit of more than 6 FFrs. Even French stations who provide as much as 20 FFrs in addition to postage have had their cards returned unanswered, sometimes covered with insults.

Lately, Antoine stopped sending cards even when the US amateur included a "greenstamp" (US $1 bill). Antoine says this is because US$1 is not enough to pay for the airmail postage back to the US, but a single card in an airmail envelope can be sent from France to the US for 4.8 FFrs, and US$1 equals 6.2 FFrs. Even with a 10% conversion tax, the US$1 more than covers the postage.

Antoine refuses to answer QSL requests from foreign DXers who do not include funds in addition to airmail return postage. He says, "People who send French stamps, Hi Hi. Never I send to W3HNK, or W4FRU, WA3HUP an SAE with $0.45. This process don't agree me. It's good only for very poor, poor peoples."

QSL via the Bureau?

Many DXers prefer to QSL via the worldwide bureau system. Antoine states in letters to F6AJA, "Those who have the real ham spirit should send all their QSLs only through the bureau, as it is my wish," and, "I prefer to receive the French QSLs via the bureau as I can take all the time to control them and to answer them twice a year via the REF." But later Antoine writes, "I have resigned from the REF. Consequently, no more QSL via the bureau." Antoine says that 98% of his French friends are not members of the REF and thus cannot receive cards via the REF bureau. (About 50% of French amateurs are members of the REF.)

Many DXers outside of France have received cards from F6FNU via their own bureau. Antoine sends cards that he receives without SAEs (or without adequate payment in addition to postage) to various bureaus worldwide, including the W2 bureau. These cards are eventually distributed via the in-coming bureau system.

How to Get a Card from F6FNU

Despite all the problems, F6FNU does QSL, if you follow his rules to the letter. Thousands of DXers around the world have learned to live with Antoine's rigid rules and receive their QSLs on a timely basis.

In fact, more than a dozen DXers wrote letters to me specifically defending F6FNU, saying he is a good QSL manager.

Many stated that by sending US$2 and an SAE, or sufficient funds in addition to return postage, they never had any problem getting cards from Antoine. Antoine even sent copies of more than 100 thank you notes he has received over the years. Obviously, the majority of amateurs are willing to accept his rules, in exchange for their QSL.

To get a card from F6FNU, first select a good-quality, unaltered QSL card, with your callsign on the same side as the report. Then carefully fill out the card, paying particular attention not to smudge or correct any of the information on the card, regardless of importance. Any errors will probably mean you will not get a return QSL, so if you make a mistake, don't correct it; start over with a new card.

Then send the card to Antoine Baldeck F6FNU, B.P. 14, 91291 Arpajon Cedex, France, with a self-addressed, airmail envelope, with your country clearly indicated on the return envelope. Don't try to use return address stickers to reduce return postage costs; Antoine doesn't like them. Don't send cards for more than one callsign in a single envelope. Include one IRC per request for Europeans, two IRCs for anyone else. Don't send French stamps or foreign currency. (Antoine says not to send US$1, but he does QSL if you send US $2, or US $1 with an SASE.)

If you follow these rules, you have a 90% chance of receiving your return QSL. Good luck!

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

PEOTONE IL
MAY 21

The annual Hamfest sponsored by the Kankakee Area Radio Society will be at the Will County Fairgrounds from 8 AM to 3 PM. Indoor exhibit area, ARRL booth, large outdoor flea market. Free parking. $2.50 advance, $3 at door. Talk-in on 146.34/.94. *KARS c/o Frank DalCanton KA9PWW, RR 1 Box 361, Chebanse IL 60922. (815) 937–2452 before 4 PM CST or (815) 932–6703 evenings.*

SCOTTSBLUFF NE
JUNE 2–4

The Tri-City Radio Amateur Club will operate W0VQN to celebrate the Centennial of Banner County. Suggested frequencies: SSB—3.920, 7.240, 14.250, 21.300, 28.400, 52.50. CW—3.725, 7.125, 14.125, 21.120, 28.130. For QSL and large certificate, send SASE to *PO Box 925, Scottsbluff NE 69363-0925.*

CATSKILLS NY
JUNE 2–5

The 3rd international convention of Chaverim International for Jewish amateur radio operators will be at the Raleigh in the Catskill mountains. Three meals a day, entertainment, use of facilities, cocktail party, dinner dance, meetings. *Sonny Gutin WB2DXB, 42 Arrowwood Court, Deptford NJ 08096. (609) 853–7889.*

JOHNSTOWN PA
JUNE 3

The Conemaugh Valley ARC will operate WA3WGN to commemorate the centennial of the flood of 1889. Operation will be on the lower General phone bands of 20 and 40 meters, and the Novice phone portion of the 10 meter band. For commemorative QSL, send #10 SASE to *Conemaugh Valley ARC, 194 Barron Ave., Johnstown PA 15906.*

DEERFIELD NH
JUNE 3

The Hosstraders flea market is back at the Deerfield Fairgrounds. New date, this spring only. Admission, $5, camping nominal. Profits benefit Shriners' Hospitals, last year's gift over $20K. Handicap accessible. Questions, map, send SASE to *WA1IVB, RFD Box 57, West Baldwin ME 04091.*

ATHENS GA
JUNE 3

The Athens Radio Club will hold its annual Hamfest at Athens Tech. VE exams, walk-ins welcome (bring copy of license). No charge for admission or flea market space. Talk-in on 146.745/.145. *Don Bullard WA4IML, (404) 742–7261 after 6 PM EST.*

MARTINSVILLE IL
JUNE 3

The Eastern Illinois Hamateur Radio Club will hold its first annual Hamfest/Craft Show at the Martinsville Fair Grounds. Admission, $3; 12 and under, free. Talk-in on 147.03/.63 and 146.52 simplex. *Mike Bumpus N9GIK, RR2, West Union IL 62477. (217) 279–3840; or Bryan Chrysler, 110 N. Randall, Martinsville IL 62442. (217) 382–4640.*

WENATCHEE WA
JUNE 3–4

Apple City ARC W7TD will hold its Hamfest at Rocky Reach Dam. $5 for hams, $1 for others. Free camp/trailer space with power. Prize drawing after Saturday potluck. Equipment displays, Swap Shop, VE exams, fish viewing room, banquet, arts and crafts. Talk-in on 2 meter FM, 146.30/.90, 147.38/.98, 146.49 simplex. *Bob Lathrop, Treasurer, 919 N. Woodward Drive, Wenatchee WA 98801.*

MADISON OH
JUNE 3–4

The Wireless Institute of Northern Ohio (W.I.N.O.), sponsored by the Lake County ARA, will operate KO8O from a winery to commemorate Ohio Wine Month from 7–11 PM EDST the 3rd on 7235 and 14235 kHz, and from 11 AM to 3 PM EDST the 4th on 14235 and 21310 kHz. For 81.5x11 QSL, send legal-sized SASE to *KO8O–WINO Weekend, 10418 Briar Hill, Kirtland OH 44094.*

QUEENS NY
JUNE 4

The Hall of Science ARC Hamfest will be at the New York Hall of Science parking lot, Flushing Meadow Park, in Queens. Amateur radio exhibit station, tune-up clinic, films, free parking, door prizes, commercial dealers. $3 admission. Sellers, $5 per space. Talk-in on 144.300 simplex link 223.800 repeat and 445.225 repeat. Call at night *Steve Greenbaum WB2KDG, (718) 898–5599 or Arnie Schiffman WB2YXB, (718) 343–0172.*

CHELSEA MI
JUNE 4

The Chelsea ARC, Inc., is sponsoring its Swap 'N Shop at the Fair Grounds. Admission, $2.50 in advance, $3 at door. YLs, XYLs, and kids under 12, free. Table space, $8, trunk sale, $2 per space. Campgrounds in area, plenty of parking, special handicap parking. Talk-in on 146.980 Chelsea Repeater. *Robert Schantz, 416 Wilkinson St., Chelsea MI 48118. (313) 475–1795.*

ST. LO, FRANCE
JUNE 6

ATTENTION D-DAY HAMS: The A.R.AM ham club in St. Lo France is seeking US hams who participated in the invasion of France on D-Day, or shortly afterwards, landing on Utah Beach. Join the A.R.AM Club on the air in a 45th anniversary commemoration. Reply with an SASE, include unit ID and date of landing to *W2QFC, 308 Parkdale Avenue, East Aurora NY 14052-1619.*

DADE CITY FL
JUNE 9–11

The East Pasco Amateur Society will operate special events station AB4LN to celebrate the Centennial of Dade City. Operations begin daily at 10 AM. Phone band operations will be 10 MHz up inside the General/10 meter Novice phone band. RTTY operations will be in accordance with the band plan. Send your confirmation QSL and business-size or 9x11 SASE for certificate. *EPARS Centennial, AB4LN, PO Box 942, Dade City FL 34297-0942.*

MIDLAND MI
JUNE 10

15th annual Hamfest, sponsored by the Central Michigan Amateur Repeater Association, will be at the Midland Community Center. Amateur electronics and equipment (new/used), license exams, door prizes. Admission, $3. Tables, $8. Talk-in on 147.000 + 0.600 MHz. *CMARA Hamfest, PO Box 67, Midland MI 48640. Please SASE or call (517) 631–9228 evenings and weekends.*

MILFORD CT
JUNE 10–11

Milford will celebrate its 350th anniversary with a special events station from 1200Z Saturday to 2200Z Sunday. Frequency will be in the lower third of the General band 80 through 15. 10 meter operation will be in mid portion of Novice phone band. 2 meter, via 146.925 repeater. Special QSL available with QSL and SASE to *PO Box 1639, Milford CT 06460.*

NEW PHILADELPHIA OH
JUNE 10–11

The Tusco ARC will operate W8ZX beginning 1700 UTC on the 10th to celebrate the 50th anniversary of the club. To promote interest in amateur radio, they will give demonstrations of packet on 145.050, and 2 meter repeater operations on 146.730. Other frequencies: 28.400, 21.340, 14.300, 7.265, 3.945. For QSL, send SASE to *W8ZX, PO Box 725, New Philadelphia OH 44663.*

AKRON OH
JUNE 11

The Goodyear Amateur Radio Club's 22nd annual Hamfest and Family Picnic will be at Wingfoot Lake Park near Akron. Family admission, $4 in advance, $5 at gate. The outside flea market will be $3 per vehicle. A sheltered, inside dealer area available, at $6 per table (reservations suggested). Prizes for the OM, XYL, and Mobile Check-in. Park facilities. No overnight, no swimming. *William F. Dunn W8IFM, 4730 Nottingham Lane, Stow OH 44224. (216) 673–8502.*

WILLOW SPRINGS IL
JUNE 11

The 32nd annual Hamfest, sponsored by the Six Meter Club of Chicago, Inc., will be at the Santa Fe Park in Willow Springs. Advance, $3, at gate, $4. Large Swapper's Row, displays in pavillion, AFMARS meeting, prizes, picnic grounds, plenty of parking. Talk-in K9ONA 146.52 or K9ONA/R 37–97. Advance tickets from *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441.*

MADISON IN
JUNE 11

The Clifty Amateur Radio Society will sponsor its 2nd annual Novice Graduation with a special events station operating 1500–2100 UTC on the 11th, using callsign W9EFU. 25 KC up from the bottom of the Novice bands. QSL with #10 SASE to *Clifty Amateur Radio Society, PO Box 452, Madison IN 47250.*

COVINGTON KY
JUNE 11

The Northern Kentucky Amateur Radio Club announces HAM-O-RAMA 89 to be held at the Erlanger Kentucky Lions Park. Main and door prizes. ARRL, packet, and antenna forums. Indoor exhibit area for major vendors, $15 per table. Extensive outside flea market. Admission, $5 ($4 in advance). Flea market spaces $2 each. Talk-in on 147.855/.255 or 147.975/.375. *N4OEB, NKARC, PO Box 1062, Covington KY 41012. (606) 331–3258.*

MILTON PA
JUNE 12

The Penn Central Hamfest will be held at the Winfield Fireman's Fairgrounds. Games, demonstrations, contests. $4 at gate, $1 per 6-foot tailgating area. Inside tables with electricity, $2 per 6-foot area. *Jerry Williamson WA3SXQ, 10 Old Farm Lane, Milton PA 17847. (717) 742–3027 or Bob Stahl, 452 4th St., Northumberland PA 17857. (717) 473–7050.*

BOULDER CO
JUNE 12–DEC 11

VE Team Test Schedule: June 12, August 14, September 24, October 16, November 13, and December 11. Pre-registration preferred. Tests at American Legion, 4760 28th St., in Boulder. Bring picture ID, one other ID, check or M.O. payable to ARRL-VEC for $4.75, original license and copy, any credits for any test elements, copy of any FCC 610 you submitted, soft pencils, calculator. *Barbara McClune N9BWS, (303) 530–1872.*

ALBANY GA
JUNE 16–17

The Albany Amateur Radio Club is sponsoring the 1989 ARRL Georgia State Convention. Awards, forums, exams, indoor flea market, commercial exhibits. Admission, $3. Parking, free. Talk-in on 146.82 MHz, 444.5 MHz, 29.68 MHz. *Albany Amateur Radio Club, POB 1205, Albany GA 31702. (912) 883–7910.*

ALBERTA CANADA
JUNE 16–18

The Central Alberta Radio League Annual Picnic will be at the Burbank Campsite. Door prizes, bunny hunt, barbecue, fun. Talk-in VE6QE 147.00/146.400 or 147.330 simplex. Register at the communications bus, $15. $5 more for private campsite. *P. Fitzgerald VE6QT, (403) 746–2621 or D. Miller VE6XF, (403) 886–4883.*

DUNELLEN NJ
JUNE 17

The Raritan Valley Radio Club will hold its 18th annual Hamfest at Columbia Park. Sellers, $6 per space or $12 for multiple spaces. No tables supplied. Buyers, $4 admission, spouse and family free. Door prizes. Talk-in on the club repeater, W2QW/R 146.025/.625 and 146.52 simplex. *Dave KA2TSM, (201) 783–4849 or John WA2C at (201) 968–5070.*

BYRON CENTER MI
JUNE 17

The Independent Repeater Association is sponsoring its annual Hamfest at the National Guard Armory. Free tables for dealers and sellers. Reserve tables. Door prizes. Talk-in on 147.165/147.765. *The Independent Repeater Association, 562 92nd St. SE, Byron Center MI 49315. (616) 455–3915.*

PETOSKY MI
JUNE 17

The Straits Area Amateur Radio Club presents its 14th annual Swap Shop at the 4H Building on the Fairgrounds. Admission, $2.50; tables, $3 per 8 feet. Door prize, small prizes each quarter-hour. Self-contained RV parking. Talk-in on 146.08/.68/.52. *Irene N8HBT, (616) 539–8986 or Clark KA8TIL, (616) 582–6455.*

MONROE MI
JUNE 18

The 1989 Monroe Hamfest, sponsored by the Monroe County Radio Communications Association, offers vendor exhibits, flea market, FCC exams, more. Handicapped parking inside the grounds. $3, advance, $4 at gate. Talk-in on 146.12/.72 and 223.18/224.78. *Larry Lindner KB8AIZ, 2001 Ida-Maybee Rd., Monroe MI 48161. (313) 587–3683.*

STEVENS POINT WI
JUNE 18

The Central Wisconsin Radio Amateurs are sponsoring their Hamfest at UWSP's Student Center. Free admission, parking. Tables available. Tailgaters welcome. VE exams, walk-ins OK. Commercial vendors and exhibits. Talk-in on 146.985/.385/.670/.070. *Art Wysocki N9BCA, 3356 April Lane, Stevens Point WI 54481. (715) 344–2984.*

MIDDLETOWN MD
JUNE 18

The Frederick Amateur Radio Club will hold its annual Hamfest on Father's Day at the Frederick County Fairgrounds. Admission, $4; tailgaters, $5 per 10-foot space. Spouses and children free. Indoor tables, $10. *Dave Durkovic N3BKD, 7128 Limestone Lane, Middletown MD 21769.*

SANTA MARIA CA
JUNE 18

The annual Santa Maria Radio Swapfest will be at the Union Oil Co. Newlove Picnic Grounds. Swap tables, prize drawings, games, Santa Maria Bar-B-Q. All proceeds support the programs of the Satellite Amateur Radio Club. Talk-in on 146.94 (down) WB6IIY/R. *Hank Korczak W6PME, 917 West Anthony Way, Lompoc CA 93436. (805) 736–1761.*

NYC NY
JUNE 26

The Radio Club of Junior High School 22 NYC, Inc., will operate WB2JKJ from 1100–2000 UTC on the above date in recognition of the first day of summer vacation for the school children of the Big Apple. 7.238 and 21.395 MHz only will be used. For an incredible QSL, send your card to *The Crew at 22, PO Box 1052, New York NY 10002.*

continued from p. 6

have learned to read—and providing you bother to take the time to read—you know that the average American parent spends less than 15 minutes a week talking with their kids. They spend much more than that yelling at them. Is it any wonder our kids don't have the incentive to do much in school? That they are messing with drugs, getting pregnant, wasting their time cruising or loafing around the mall, smoking, and have little focus in life?

So, in annoyance, we push our schools to pass 'em anyway. And we watch the SAT scores plummeting. We watch America being passed by Japan, Taiwan, Singapore, and Korea. We read with dismay that our kids can't read and don't even know where our country is on a world globe. We read that only 7% of our high school graduates can even hope to cope with an engineering college. We read about less than 10% having any physics in high school. We read about our graduating technological illiterates—into a world which is technology-driven.

As Pogo once said, "We have met the enemy and he is us." Just as we neglect our pets and put up with their bad habits, we have also neglected our children. Then, when they "go bad" we throw them out. Throw out the pregnant teenage daughter. Throw out the drug-using kid. "Get the hell out of here and don't come back." Blame them, not us.

The loved child isn't going to shoot his parents or run away from home.

What's more important to you: a temporary fix from the Today Show; quickly forgotten entertainment-driven news; totally wasted time with Geraldo, Oprah, or Donahue; an evening of brainless sitcoms; or working with your kids to help them cope with life? Can you turn off the TV and miss football?

No, I see the problems which face amateur radio as just a reflection of those facing our country. Have you brought forth a whiny, complaining youngster who wants everything made easy? Or do your kids move heaven and earth to learn and excel—like the Asian youngsters? How hard will they work to achieve things?

Our educational system is a shambles because we've let it get that way. We've refused to be involved. Anything which is neglected is going to deteriorate, right? As parents we've neglected our kids, and our educational system. As hams we've neglected our hobby. Perhaps it's approaching time to rethink our priorities.

I wish I had some easy solutions to getting kids interested in amateur radio. For two years now I've been asking the *73* readers to look around for some way to get kids into the hobby. For two years I've had almost no letters from readers explaining how they've attracted kids to hamming. I've had plenty of mail from disgusted hams blaming the kids for not being interested.

I've had plenty of letters with excuses. Kids are interested in computers now. They see the world on TV, so they haven't any interest in talking with foreign hams. They're too busy with other interests. There are too many things for kids to do.

Baloney! When I got into hamming I wasn't exactly short of other interests. I was a Boy Scout, complete with troop and patrol meetings, hikes, weekend camping trips, and so on. I sang in the St. Paul's Church choir, which kept me busy three times a week practicing and two performing. I also sang in the Erasmus Hall High School Choral Club, where we practiced five days a week. I sang in the Savoyards two days a week, and with the Philharmonic Choir of Brooklyn two days a week. I was into photography and the school camera club—including an amazing number of hours in the YMCA darkroom. I didn't miss much in movies, going two or three times a week. I roller-skated all over Brooklyn in the evenings with friends, went ice skating and sledding in the winter, swimming at Coney Island in the summers. And yes, dancing lessons, too.

In between building electronic gadgets—a hi-fi system, receivers, transmitters and test equipment—I had fun experimenting with making explosives, ran a small mail order stamp business (Elm Stamp Company), took voice lessons, was a member of the book club in school (read a lot), and loved to play card and board games with my folks and their friends.

I've talked with some of the few young hams we have attracted to our hobby and found that they, like me—and probably like you, when you were a kid—have plenty of interests from which to choose. The difference for them, as for me, was the support of a local ham club. If my high school hadn't had a ham club I wouldn't be haranguing you now.

How can you get your own kids to be interested in amateur radio? Easy. But first you have to gain their confidence. You have to learn how to talk with them. That, as I mentioned earlier, is a lot like the system you use to train animals—you spend some time with them and use love. Do things with them. Talk with them.

If you get interested in this you'll have to be careful. After years of neglect you aren't going to be able to get them to talk right away. They'll be very suspicious at first. You'll have to figure out how to get them to turn off their TV or turn off the heavy metal sound so they can hear you. Good luck.

I'd still like to hear from any readers who have had success in getting a youngster interested in amateur radio. I know there have to be dozens who have made the grade, so let's hear from you! What can you tell us to help?

Once you manage to get in communication with your kids, you're going to be appalled by what's happened to our educational system and you're going to start putting on the pressure to improve it.

We all know that technology is the future and that electronics is the engine driving technology. We also know that the best time to get kids interested in becoming an engineer or scientist is when they are ten to fifteen years old. So we need to get those radio clubs going in schools again. We need computer clubs, science fair project clubs, etc. As you get more and more involved with your schools you'll find one obstacle after another—almost insurmountable obstacles. Don't let that stop you.

You'll face bussing, fierce union demands for extra teacher pay to monitor clubs, after-school sports. Well, if you want to see America ever get back first place in electronics, you'd better be able to solve all these problems. You'll have one big asset—me and *73* backing you up and helping you network with other parents (and grandparents). I can't do it all, but I sure can help you. That's providing I can get you away from your TV set long enough to talk with your kids. And away from that 75m net, too.

Yes, I'm asking the almost impossible. I'm asking you to try and love that mewling, whiny kid of yours who is forever in need of money to spend on beer which will eventually get him killed in an accident, fast food which will give him heart trouble in a few years, cigarettes which will take at least fifteen years off his life, who is listening to rock music at a level which will cause permanent ear and possibly brain damage. . . and who wouldn't be caught dead in your ham shack.

America is only about a million engineers short right now, so it isn't an emergency. Besides, I'm sure you've read that over half the engineering graduates from American colleges are foreigners, with a high percentage from Asia. If you've been reading the science columns in the news and science magazines you are well aware of the high percentage of Asian names turning up in every new technology.

Electronics is moving ahead faster and faster and, because of our lack of engineers, we're being left behind. You know, as a result of that Incentive Licensing debacle 25 years ago, America has lost about two million of the best possible engineers, technicians and scientists that amateur radio would have provided.

So, if you have youngsters or grandchildren, what are you going to do about taking an interest in them? In their education? And in getting them into amateur radio?

Please advise.

New Technologies

The FCC's Office of Engineering and Technology (OET) seems to have considerable clout within the FCC and could have a serious impact on amateur radio.

It's the FCC's responsibility to apportion the radio spectrum in the best interests of the country. With electronics and communications growing at a faster and faster pace, and the Hertz resource unchangeable, obviously something is going to have to give.

AM broadcasters want more channels. FM broadcasters want more channels. TV wants wider channels for high definition TV. Cellular radio is growing rapidly—as are mobile services for business, government and the military. Then, there are an increasing number of radio services such as portable phones, TV distribution systems, alarm systems, paging systems—the list is almost endless and expanding every day.

With over 70 MHz of spectrum under 1 GHz, the amateur radio "service" is one of the largest spectrum holders. Older hams are so used to having this enormous number of frequencies reserved for their personal, private hobby use that few even question the rationale involved. I've written several editorials mentioning the incredible dollar value of our ham bands, but I suspect many hams just chuckle a bit and never give any serious thought to the situation.

Let's put it this way. If you were a decision-maker in the OET, what would you recommend the FCC do? You've got an increasing number of groups clamoring for radio spectrum, yet it's all allocated. If any current services are going to expand or any new ones be permitted, frequencies are going to have to be taken from some current user. Where are you going to get them?

When you take an inventory of the radio spectrum under 1 GHz, looking at national interest in the light of service and business interests, what frequencies are being used the least in the public interest?

We amateurs have our reserved bands with the understanding, as expressed clearly in the amateur regulations 97.1, that we continue to merit them by maintaining a supply of newcomers interested in technology who (1) can help in time of war, (2) provide emergency communications, (3) invent and pioneer new communications technologies, and (4) improve international friendships. That's our mandate—our leasing agreement for the billions of dollars in radio spectrum set aside for us.

If you were an OET investigator, you'd check out our actual ham band usage and turn in a devastating report. In WWII, 80% of the licensed hams joined the military and provided an invaluable resource. WWII was won by electronic technology and hams were right in the middle of it—doing research and development, manufacturing, operating, and servicing.

I worked for General Electric in 1942, building and testing BC-191/375 transmitters for the Army. Then I joined the Navy, where I operated and maintained radio, sonar, and radar equipment on the USS Drum (one of the top ten scoring submarines) from 1943–1945—so I was there and know what a big difference hams made.

Today, what have we to offer? The number of hams of military age are miniscule—and, in general, hams are so far behind the state of the art in communications technology that we're still fighting over Morse Code at a few words per minute in a day where 8,000 word a minute electronic communications is common. Hams haven't contributed anything significant to communications technology in over a generation, so that excuse for the hobby is moot.

We're still getting good marks in emergency communications—but more from a lack of competitors than our own expertise. The fact is that when an emergency comes along our so-called emergency nets fall apart. Our National Traffic System only seems to work when it isn't needed. It's still made up of brass-pounders, and still isn't able to pass high speed or automatic traffic. It's more wrapped up in message counts and protocols than throughput, as those involved saw during recent emergencies such as the Mexico City earthquake. Can packet radio already run circles around our traffic

nets, as so many involved are saying?

International good will? Har de har. I've written about that recently and gotten many letters from foreign hams backing my observations that DX awards kill the fun of hamming for ops in rare countries. They're hounded off the air for their QSL cards and are almost never allowed to actually talk with anyone.

When is the last time you tuned six meters? How many dozen hams would be inconvenienced if six were taken away for some new service? Not many! That's four whole megahertz! Well, at least two meters is full, right? Horsepucky! I've been listening to 2m all around the country and what I hear are repeaters being used to allow retired hams to die from boredom instead of loneliness. I hear very few repeaters where I can even get an answer when I call in, so I know hardly anyone is actually using them. And that's what's "filling" two meters. If you ever get to New York or Los Angeles, check out 2m and you'll hear garbage you don't even hear on CB anymore—incredible filth.

220? Tell me about how much you are using 220. The FCC's opened part of the band to Novice voice, but the Novices are ignoring the band and flocking to 10m, where they can make phone contacts with skip stations. The clubs with 220 repeaters are, for the most part, willing to go to great lengths to keep the imagined hordes of Novices from polluting their repeaters.

In the meanwhile, we seem to have forgotten that hams were given only temporary use of 220–225 MHz, not permanent ownership. So tempers flared when the FCC had the gall to suggest that some of the band might be put to some better use. Hey, that's OUR band they're trying to take away. Well, it was never OUR band and our use of it during its loan hasn't been anything of which we can be proud. I remember passing out buttons at hamfests twenty years ago which said, "220—use it or lose it." Well, for the most part, we never could be bothered to use it. How else could we have proven to the FCC that we needed 220–225 MHz? We're awfully big on griping and low on using.

Then there's 450 MHz—which has almost entirely been taken over for remote control and relay operations. Much of this could just as well be on 10.5 GHz. Most controlling could be done on channel on two meters these days. How much use of any value to our country do we contribute on 450? Yes, I know there are exceptions—but that's what they are: exceptions.

Is it all doom and gloom? Well, not if there's a solution to the problem. Right now we're in the weakest position we've ever been in with amateur radio—and that's because so many old timers are willing to take the hobby right on down with them to the grave. We need young Novices, need 'em by the hundreds of thousands. With new blood coming in we will be able to honestly say that we're a viable service and rate the government reserving our frequencies for us.

I'm still hearing old timers on the air, and getting letters from them saying all is hunky-dory, that there's nothing to worry about—ham radio is growing just fine—that we must keep on the pressure for the Morse Code. They're still doing all they can to keep youngsters out of their clubs, still doing nothing to help school clubs get started, and still will have nothing to do with Novices.

So, if you were an OET investigator, what would you recommend to the FCC? Be honest now.

Well, yes, but listen to how crowded 20m is these days—right? Sure, but it's awash in a 30-year old technology which should have been replaced years ago by much narrower band systems. Complaining about the QRM on 20m today is like beefing about the QRM back in the old spark days—and we're just two generations away from there, when we should be three or four.

We have the technology today to narrow our voice channels down to a few Hertz—using digital techniques and chips. We could get hundreds to thousands more voice channels on 20m, each with far less interference than we have right now. We could if we had some experimenters left. Alas, most of them have died or retired, and our lack of youngsters coming into the hobby has cut off our major input from these chaps for the last twenty-five years.

Will the broadcast industry be able to get the rest of 220 MHz for a new FM band? They tried once to get it, failed, and are now trying again. Their prospects are brighter this time. Their proposed service makes sense as a place for a new digital FM service with 200 kHz channels.

The time when amateur radio could count on holding on to the ham bands without having any real justification may be passing. The question you should be asking today is this: How many Novices has my ham club generated this month?

You have noticed the full pages of Silent Keys in *QST*, haven't you? You may be sure the OET noticed. With the average ham age approaching 60, this list will be heading toward two pages a month as the smokers and overweight hams blow away. It takes ten years for the FCC list to catch up, so many old-timers will continue to believe the seriously inflated figures we've been seeing. QRM? Hey, the last two hams left on 20m will both be calling CQ at the same time on the same frequency.

The Japanese are serious about amateur radio. Perhaps you've noticed that all of the technical innovations in our rigs for the last twenty years or so have come from Japan—like our incredibly small synthesized hand-held and our new computer-controllable synthesized rigs. They've been attracting youngsters in Japan—hundreds of thousands of them. It only takes one look at any of their ham magazines to see the difference. *CQ/Ham Radio* is fatter than all of our ham rags combined, running well over 600 pages a month. Every issue is packed with great construction projects, a whole section on club activities, contests. They have a much wider selection of ham gear than we. Many Japanese ham manufacturers don't bother to try and sell to the small ham market we have left here.

With the OET on the move, the day of reckoning—the day many older hams have been blind to and refuse to even face—may be approaching. Is it already too late? I don't know. You tell me. Do you think there is any fight left in the mass of retired hams who are enjoying the hobby they've inherited from the pioneers who won it for them fifty years ago? Do you think they care about the future enough to get Novice programs going in their clubs and start reversing the trend of the last twenty-five years?

On every side we see the importance of electronics—the incredible developments in video, computers, and communications. We hams know perhaps better than most other people the way these developments will shape the future of the world as technically improved education systems bring down costs, as communications do more and get cheaper via satellites and fiber optics.

"CQ/Ham Radio *(Japan)* is fatter than all of our ham rags combined . . ."

The compact disc application of digital data storage to audio has turned into the fastest growing consumer electronics industry in history. Now we're getting ready for digital video, high definition TV, and many other remarkable developments—all coming from Japan. Indeed, the Japanese may have lost the military war forty years ago, but they're winning the economic war—and winning much of it with electronics which they're using in cars, cameras, and to take away every consumer electronics industry from America with both home and office products.

Oddly enough, the American shortfall in electronics engineers, technicians, and scientists is just about what amateur radio would have contributed to our country if we'd not suddenly stopped ham growth twenty-five years ago. Blaming the ARRL or the FCC for this now is pointless. The need is to recognize the problem and solve it, to figure out how to generate the needed technical people to get America back in the technological race and thus to help regain American economic clout. Until then we'll have to get used to more and more Japanese-owned hotels and businesses here.

No, of course this isn't the only problem America has. We desperately need someone in Washington who has the responsibility to get America back to Number One. Someone to tackle the educational and tax problems which have contributed to our downfall. Someone to organize us to get back to being Number One.

In hopes of throwing some light on this need I tried throwing my *73 Magazine* baseball cap into the New Hampshire political ring, aiming at the Vice Presidency. My idea was to elect a vice president who would have actual work to do, just like in any corporation. The job of sitting around waiting for an accident wastes a valuable person. I'd like to see himbe in charge of the national economy, while the president is mainly involved with international problems. The VP would report to the president, just like a corporation.

This would give some clout at the top level for modernizing our educational system, developing ways to cut educational costs, making it easier for small businesses to start and grow, and to encourage American firms to outdo the Japanese in newer technologies.

The local press was much more interested in reporting again on my losing battle with the IRS 15 years ago than on my ideas for improving education, cutting college costs, and regaining American technical leadership. I picked too big an outfit to fight, believing that being right would win.

If I were to become VP you can bet I'd get simple courses on basic electronics into every grade school in the country—and I'd get 'em to start thousands of radio, computer, electronic experimenter, and science fair clubs to get kids personally interested in learning, building, and experimenting.

I'd make sure kids understood how computers, photocopiers, facsimile, telephone systems, cameras, radios, televisions, video recorders, tape recorders, etc., all work. They'd be familiar with CD, CDV, CDI, HDTV, and so on. They'd know how microprocessors work, how to program computers, and understand digital electronics—all by the age of 15.

I'd encourage schools (and colleges) to test and use more productive teaching systems. I'd encourage colleges to try work-study programs to cut tuition costs. I'd encourage all schools to go to 50-week a year teaching to make better use of schools and teachers.

How about encouraging video instruction systems such as CD-I to help more youngsters learn to read—to help high school dropouts learn—to re-educate workers who need to learn new skills?

These ideas aren't from left field. I've talked them over with many college presidents and have found them all most receptive. But the need is for pressure from the government to bring about needed changes.

Will America lose out on fiber optics—on superconductors—and many new electronics technologies? Japan is working hard to beat us. What are we doing? Japan knows they still have to fight to keep ahead, but the message hasn't penetrated here yet. So here we are with Japan the number one country in the world in technology and finance, while America has the highest foreign debt in the world and even has to turn to Japan with military electronic R & D contracts.

For starters I'd like to run a list of the American ham clubs and the number of new Novices they're graduating. Please have the secretary of your club send me a card or note every month telling me how many Novices your club graduated last month. Please send me pictures of your club Novice graduating classes for possible publication in *73*. I'll come up with an award for the top clubs in recognition of their interest in helping our country.

What else would you suggest we can do? 73

DEALER DIRECTORY

CALIFORNIA

Burbank

New HAM store open and ready to make a DEAL. We carry all lines, ship UPS, and are open Sunday. **A-TECH ELECTRONICS, 1033 Hollywood Way, Burbank CA 91505; (818) 845-9203.**

San Diego

Hard to find parts, surplus electronics, standard line items. Hams, hobbyists, industrial professionals—from nuts & bolts to laser diodes...Electronically speaking, Gateway's got it! M-F 9-5:30 Sat. 9-5. **GATEWAY ELECTRONICS, 9222 Chesapeake Drive, San Diego CA 92123; (619) 279-6802.**

COLORADO

Denver

Hard to find parts, surplus electronics, standard line items. Hams, hobbyists, industrial professionals—from nuts & bolts to laser diodes...Electronically speaking, Gateway's got it! M-F 9-5:30 Sat. 9-5. **GATEWAY ELECTRONICS, 5115 N. Federal Blvd. #32, Denver CO 80221; (303) 458-5444.**

Englewood

Rocky Mountain Amateur/Shortwave Specialists. Ten-Tec, Yaesu, JRC-NRD, Sony, MFJ, KLM, and other fine gear. New and Used. Visa/MC. Antennas, Books, and Discount Prices, too! **ALLIED APPLIANCE & RADIO, 4253 South Broadway, Englewood, CO 80110; Orders, (800) 321-7305; Info, (303) 761-7305.**

DELAWARE

New Castle

Factory authorized dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **DELAWARE AMATEUR SUPPLY, 71 Meadow Road, New Castle DE 19720; (302) 328-7728.**

IDAHO

Preston

Ross WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **ROSS DISTRIBUTING, 78 S. State, Preston ID 83263; (208) 852-0830.**

KANSAS

Wellington

We have it! ASTRON, BUTTERNUT, ENCOMM, HEATHKIT, GORDON WEST, KANTRONICS, LASER COMPUTERS, MFJ, RADIO SHACK, TEN-TEC, VALOR ANTENNAS & more. Small town service with discount prices. **DANDYS, 124 So. Washington, Wellington, KS. 67152, (316) 326-6314.**

MISSOURI

St. Louis

Hard to find parts, surplus electronics, standard line items. Hams, hobbyists, industrial professionals—from nuts & bolts to laser diodes...Electronically speaking, Gateway's got it! M-F 9-5:30 Sat. 9-5. **GATEWAY ELECTRONICS, 8123 Page Blvd., St. Louis MO 63130; (314) 427-6116.**

NEW HAMPSHIRE

Derry

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, B&W, Cushcraft, Encomm, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours Mon.-Sat. 10-5, Thursday 10-7. Closed Sun./Holidays. **RIVENDELL ELECTRONICS, 8 Londonderry Road, Derry NH 03038; (603)434-5371.**

NEW JERSEY

Lyndhurst

A full service Ham Radio Store! Discount sales and service on most major brands. Monday to Friday 10:00am to 7:00pm, Saturday 9:00am to 3:00pm ¼ mile south of Rt.3. **ABARIS SYSTEMS, 227 Stuyvesant Avenue, Lyndhurst NJ 07071; (201) 939-0015.**

Park Ridge

Bergen County's oldest and only SWL/Amateur dealer. Specializing in HF receiving systems, antennas, ham/SWL accessories, books. Kenwood, JRC, Yaesu, Icom. 1 mile from Garden State Parkway Exit 172. Tu-Fri 10-5; Sat 10-3. **GILFER SHORTWAVE, 52 Park Avenue, Park Ridge, NJ 07656; (201) 391-7887.**

NEW YORK

Jamestown

Western New York's finest amateur radio dealer featuring ICOM-Larsen-AEA-Hamtronics-Astron. New and used gear. **VHF COMMUNICATIONS, 915 North Main St., Jamestown NY 14701, (716) 664-6345.**

Manhattan

Manhattan's largest and only ham and two-way Radio Store. Featuring MOTOROLA, ICOM, KENWOOD, YAESU, AEA, SONY, UNIDEN, etc. Full stock of radios and accessories. Open 7 days M-F, 9-6:30 pm; Sat & Sun, 10-5 pm. We ship worldwide. **BARRY ELECTRONICS, 512 Broadway, New York NY 10012; (212) 925-7000. FAX (212) 925-7001.**

NORTH CAROLINA

Greensboro

9a.m. to 7p.m. Closed Monday. ICOM our specialty-Sales & Service. **F&M ELECTRONICS, 3520 Rockingham Road, Greensboro NC 27407; (919) 299-3437.**

OHIO

Columbus

Central Ohio's full-line authorized dealer for Kenwood, ICOM, Yaesu, Ten-Tec, Info-Tech, Japan Radio, AEA, Cushcraft, Hustler, and Butternut. New and used equipment on display and operational in our 4000 sq.ft. store. Large SWL department, too. **UNIVERSAL AMATEUR RADIO, 1280 Alda Drive, Reynoldsburg (Columbus) OH 43068; (614) 866-4267.**

PENNSYLVANIA

Trevose

Authorized factory sales and service. KENWOOD, ICOM, YAESU, featuring AMERITRON, B&W, MFJ, HYGAIN, KLM, CUSHCRAFT, HUSTLER, KANTRONICS, AEA, VIBROPLEX, HEIL, CALLBOOK, ARRL Publications, and much more. **HAMTRONICS, INC., 4033 Brownsville Road, Trevose PA 19047; (215) 357-1400. FAX (215) 355-8958. Sales Order 1-800-426-2820.**

TEXAS

Dallas

In Dallas since 1960. We feature Kenwood, ICOM, Yaesu, AEA, Butternut, Rohn, amateur publications, and a full line of accessories. Factory authorized Kenwood Service Center. **ELECTRONIC CENTER, INC., 2809 Ross Ave., Dallas TX 75201; (214) 969-1936.**

Houston

Hard to find parts, surplus electronics, standard line items. Hams, hobbyists, industrial professionals—from nuts & bolts to laser diodes...Electronically speaking, Gateway's got it! M-F 9-5:30 Sat. 9-5.**GATEWAY ELECTRONICS, 9890 Westpark Drive, Houston TX 77063; (713) 978-6575.**

Southwest Houston

Full line of Equipment and Accessories, in-house service, Texas #1 Ten Tec Dealer! **MISSION COMMUNICATIONS, 11903 Alief-Clodine, Suite 500, Houston TX 77082; (713) 879-7764.**

DEALERS

Your company name and message can contain up to 25 words for as little as $300 yearly (prepaid), or $175 for six months (prepaid). No mention of mail-order business permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '89 issue must be in our hands by February 1st. Mail to *73 Amateur Radio*, Rebecca Niemela, Box 278, Forest Road, Hancock, NH 03449.

800-882-1343

ICOM

ICOM	List	JUN's
IC-781 New Deluxe HF Rig	$5995	Call $
IC-765 Gen. Cvg Xcvr	3149.95	Call $
IC-735 Gen. Cvg Xcvr	1099	Call $
IC-751A Gen. Cvg Xcvr	1699	Call $
Receivers		
IC-R7000 25-1300* MHz Rcvr	1199	Call $
IC-R71A 100 kHz-30 MHz Rcvr	999	Call $
VHF		
IC-228A/H FM Mobile 25w/45w	509/539	Call $
IC-28A/H FM Mobile 25w/45w	469/499	Call $
IC-02AT FM HT	409.95	Call $
IC-2GAT 2m 7w HT	429.95	Call $
IC-900 Six Band Mobile	639	Call $
UHF		
IC-48A FM Mobile 25w	509	Call $
IC-04AT FM HT	449	Call $
IC-4GAT New 6w HT	449.95	Call $
220 MHz		
IC-38A 25w FM Xcvr	489	Call $
IC-32AT 2m/70cm HT	629.95	Call $

SPECIAL	LIST	SALE
IC-12AT	$473.95	$340.95
IC-37A	$499.95	$299.95

KENWOOD

RZ-1 WIDEBAND RCVR	599.95	Call $
HF Equipment		
TS-940S/AT Gen. Cvg Xcvr	2449.95	Call $
TS-440S/AT Gen. Cvg Xcvr	1449.95	Call $
TS-140S Gen. Cvg Xcvr	949.95	Call $
VHF/UHF		
TM-55AT 2m-70cm 1.2 GHz	469.95	Call $
TS-790A 2m-70cm 1.2 GHZ	1999.95	Call $
TS-711A All Mode Base 25w	1059.95	Call $
TR-751A All Mode Mobile 25w	699.95	Call $
TM-231A 2m 45w	459.95	Call $
TH-215A 2m HT Has It All	399.95	Call $
TH-25AT 5w Pocket HT NEW	369.95	Call $
TM-721A 2m/70cm FM Mobile	729.95	Call $
TM-701A 2m/70cm Mobile	599.95	Call $
TH-75A 2m/70cm HT	TBA	———
TM-431A Compact FM 35w	699.95	Call $
TH-45AT 5w Pocket HT 220 MHz	389.95	Call $
TM-3530A FM 220 MHz 25w	519.95	Call $
TM-321A Compact 25w Mobile	469.95	Call $
TH-315A Full Featured 2.5w HT	419.95	Call $

YAESU

YAESU		
HF Equipment		
FT-767 GX Gen. Cvg Xcvr	1929.00	Call $
FT-757 GX II Gen. Cvg Xcvr	1129.95	Call $
FT-747 GX New Economical Performer	889.95	Call $
FL-7000 15m-160m AMP	1995.00	Call $
VHF		
FT-212RH NEW 2m 45w	459.95	Call $
FT-712RH 70cm 35W	499.95	Call $
FT-290R All Mode Portable	599.95	Call $
FT-23 R/TT Mini HT	344.95	Call $
VHF/UHF Full Duplex		
FT-736R, All Mode	1749.95	Call $
FT-470 2m/70cm HT	559.95	Call $

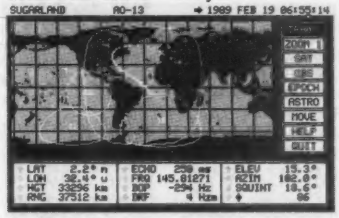
JUN'S ELECTRONICS

3919 Sepulveda Blvd.
Culver City, CA 90230
213-390-8003

CIRCLE 272 ON READER SERVICE CARD

GET A BIRD'S EYE VIEW

From GrafTrak II™ and your IBM® PC



GrafTrak II™ provides real-time graphic display of a flat projection map that moves under selected satellite/Sun/Moon/star coverage circle and updates once per second.

The Silicon Ephemeris™ gives tabular data output to the screen, printer or disk file. Editing, data base update and rotator/receiver control programs also included.

Requires an IBM PC, PC/XT, PC/AT, or true compatible, an IBM Color/Graphics Monitor Adaptor or true compatible, optional but recommended 80x87 math comprocessor, minimum 512K RAM, DOS 2.0 or later, and either two 360K floppy drives or one 360K floppy and one hard drive; the programs are not copy protected.

SEE DETAILED PRODUCT REVIEW IN THE APRIL '89 ISSUE OF *73*.

COMPLETE PACKAGE **$395 LIST**.

CALL FOR QUOTATION

(713) 777-3057

Silicon Solutions, Inc.
P.O. Box 742546
Houston, TX 77274-2546

IBM is a registered trademark of IBM Corporation. GrafTrak II and Silicon Ephemeris are trademarks of Silicon Solutions, Inc.

THE RF CONNECTION

"SPECIALIST IN RF CONNECTORS AND COAX"

Part No.	Description	Price
PL-259/USA	UHF Male Phenolic, USA made	$ .70
83-1SP-1050	PL-259 Phenolic, Amphenol	.89
83-822	PL-259 Teflon, Amphenol	1.75
PL-259/ST	UHF Male Silver Teflon, USA	1.50
UG-175	Reducer for RG-58	.20
UG-176	Reducer for RG-59 & MINI 8	.20
UG-21D/U	N Male RG-8, 213, 214, Delta	3.25
UG-218/U	N Male RG-8, 213, 214, Kings	5.00
9913/PIN	N Male Pin for 9913, 9086, 8214 fits UG-21D/U & UG-218/U N's	1.50
UG-21D/9913	N Male for RG-8 with 9913 Pin	3.95
UG-218/9913	N Male for RG-8 with 9913 Pin	5.75
UG-146A/U	N Male to SO-239, Teflon USA	6.00
UG-83B/U	N Female to PL-259, Teflon USA	6.00

"THIS LIST REPRESENTS ONLY A FRACTION OF OUR HUGE INVENTORY"

THE R.F. CONNECTION
213 North Frederick Ave. #11
Gaithersburg, MD 20877

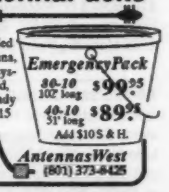
(301) 840-5477

PRICES DO NOT INCLUDE SHIPPING
PRICES SUBJECT TO CHANGE
VISA, MASTERCARD, ADD 4%
UPS C.O.D. ADD $3.00 PER ORDER

CIRCLE 115 ON READER SERVICE CARD

Field Day AntennaPacks

EmergencyPacks contain QRV All Band kink-proof wx-sealed multi-band Dipole-V-Sloper antenna, 70' coax feedline, Quick Launch system, rotproof dacron support braid, 40 p Tech Manual. Complete. Ready for Action. One person installs in 15 minutes. Infopack $1



Fastest Antennas in the West
Box 50062-S, Provo, UT 84605
AntennasWest (801) 373-8425

CIRCLE 90 ON READER SERVICE CARD

JOIN ARRL

BENEFITS FOR YOU

QST, QSL Bureau, Awards, Low Cost Insurance, Operating Aids, Government Liaison and More—Much More!

MEMBERSHIP APPLICATION

Name _____ Call _____

Street _____

City _____ Prov./State _____ PC/ZIP _____

$25 in U.S. $36 elsewhere (U.S. funds) Licensed amateurs, or age 65 or over, upon submitting proof of age, may request the special dues rate of $20 in the U.S. $28 elsewhere, in (U.S. funds) Persons age 17 and younger may qualify for special rates, write for application.

For postal purposes, fifty percent of dues is allocated to QST, the balance for membership.

Charge to ☐ VISA ☐ Mastercard ☐ AMEX ☐ Discover Expires _____

Card Number _____ Signature _____

The American Radio Relay League
225 Main St. Newington, CT. 06111 USA

BARTER 'N' BUY

QSLs TO ORDER. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DX-CC Honor Roll Certificate 2–4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

QSL CARDS- Look good with top quality printing. Choose standard designs or fully customized cards. Better cards mean more returns to you. Free brochure, samples. Stamps appreciated. Chester QSLs, Dept A, 310 Commercial, Emporia KS 66801. BNB434

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. $10. LEARN MORSE CODE IN 1 HOUR. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog: SASE. Bahr, Dept 73-6 2535 Marietta, Palmbay FL 32905. BNB531

SB-220/221 OWNERS: 17 detailed mods which include 160–6 meter operation, QSK, +enhanced p.s. 50% rebate for new mods submitted! 9 pages of 3-500Z tech info. $11 postpaid.—Info. SASE. BOB KOZLAREK WA2SQQ, 69 Memorial Place, Elmwood Park NJ 07407. BNB581

ELECTRONIC KITS & ASSEMBLIES. For our latest catalog, SASE (45¢) to: A&A Engineering, 2521 W. LaPalma, #K, Anaheim CA 92801. BNB624

COMMUNICATIONS BATTERIES: CLONE-PACKS! Ready-for-use. ICOM: BP-3S Double BP3 "Wall Chargeable" $43.95, BP5 $43.95, YAESU: FNB2 $21.95, SANTEC: 142/442/1200 (3 Pin) $23.95. "REBUILDING—SEND-UR-PACK" Icom BP3 $20, BP5 $28, BP7/8 $34, Yaesu FNB4/4A $38, Kenwood PB21 $18, PB25/H/26 $28, T-T 2991 $29. "U-DOIT REPAIR INSERTS" ICOM: BP2 $18.95, BP3 $16.95, BP5 $23.95, BP7/BP8 $28.95, KENWOOD: PB21 $12.95, PB24 $19.95, AZDEN 300 $19.95, YAESU: FNB4/4A $32.95, TEMPO: S1,2,4,5,15/450 $22.95, "ANTENNAS" 2MTR 5/8-Tel/BNC $18.95. "MUCH MORE" SASE-Catalog. PA +6%. $3 Shipping/order. Visa-M/C +$2. (814) 623–7000. CUNARD ASSOCIATES, Dept. 7, R.D. 6 Box 104, Bedford PA 15522. BNB628

CALLSIGN JEWELRY. Unique. Beautiful. Free catalog: SASE. Bahr, Dept 73-6, 2535 Marietta, Palmbay, FL 32905. BNB629

ROSS' $$$$ NEW June SPECIALS: KENWOOD TH-215A $309.90, TH-25AT $277.70, TM-721A $609.90, TS-440S/WAT $1229.90, TS-711A $895.90, NYE-VIKING MB-V-A $554.90, RFM-003 $213.90. ICOM IC-228H $459.90, IC-37A $348.50, IC-32AT $539.90, IC-725 $809.90. MFJ 949C $134.90, 986 $239.90, 1278 $224.90, YAESU FT-727R $409.90, FT-747GX $669.90, FT-109RH $276.99, FT-209RH $276.99, FT-73RTT $289.90, FT-33RTT $299.90, FT-736R $1499.90, FTV-707DM $242.90, SC-1 $189.90. ALL L.T.O. (LIMITED TIME OFFER) LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. Over 8780 ham-related items in stock for immediate shipment. *Mention ad.* Prices cash, F.O.B. PRESTON. WE CLOSE at 2 PM MONDAYS & ALL DAY SATURDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, (P.O. Box 234), PRESTON ID 83263. (208) 852–0830. FAX (208) 852–0833. BNB654

WRITTEN EXAMS SUPEREASY. Memory aids from psychologist/engineer cut studytime 50%. Novice, Tech, Gen: $7 each. Advanced, Extra: $12 each. Moneyback guarantee. Bahr, Dept 73-6, 2535 Marietta, Palmbay FL 32905. BNB691

ROSS $$$$ USED June SPECIALS: KENWOOD TH-205AT $229.90, ST-2 $69.90, TR-2400 $169.90, TS-930S W/AT $1399.90, COLLINS KWM2 $499.90, KWM-380W/FL,NB $1995.90, 32-S1 $249.90. ICOM U2AT $239.90, 701PS $109.90, R-7000 $849.90. YAESU FT-901DM/W XF8.9HS,XF8.9HCM $599.90, FT-101E $499.90, FT-780R $399.90, FTV-250 $169.90. ALL L.T.O. (LIMITED TIME OFFER). LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. WE HAVE OVER 235 USED ITEMS in stock. *Mention ad.* Prices cash, F.O.B. PRESTON. WE CLOSE AT 2 PM MONDAYS & ALL DAY SATURDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, P.O. BOX 234, PRESTON ID 83263. (208) 852–0830. FAX (208) 852–0833. BNB709

$50 PACKET DIGICOM>64—A fantastic software based PACKET system for the Commodore 64. Order KIT #154 for $49.95 or Assembly #154 for $79.95, both include FREE DISC. Add $3.50 s/h. A & A Engineering, 2521 W. LaPalma, #K, Anaheim CA 92801. (714) 952–2114. MC or VISA accepted. BNB732

HAM TRADER YELLOW SHEETS. In our 28th year. Buy, Swap, Sell ham radio gear. Published twice a month. Ads quickly circulate, no long wait for results. Send business size SASE for sample copy. $13 for one year (24 issues). P.O.B. 2057, Glen Ellyn IL 60138-2057 or P.O.B. 15142, Seattle WA 98115. BNB741

$$$$$ SUPER SAVINGS $$$$$ on electronic parts, components, supplies, and computer accessories. Send one dollar for 1-year subscription to our 40-page catalogs and their supplements. Get on our mailing list. BCD ELECTRO, PO Box 830119, Richardson TX 75083 or call (214) 343–1770. BNB749

HAM RADIO REPAIR, all makes, models. Experienced reliable service Robert Hall Electronics, Box 280363, San Francisco CA 94128-0363. (408) 729–8200. BNB751

WANTED: Ham Equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a non-profit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Get an incredible QSL for working our special event—June 26, 1100 to 2100 UTC, 7.238/21.395 MHz. Call WB2JKJ and the crew celebrating the first day of summer vacation. Please write us at: PO Box 1052, New York NY 10002. Round the clock Hotline: (516) 674–4072. Thank you! BNB762

INDIVIDUAL PHOTOFACT FOLDERS. #10 to #1400, $4.00. #1401 up, $6.00. Sam's books, $7.00. Postpaid. Allen Loeb, 414 Chestnut Lane, East Meadow NY 11554. BNB766

VHF TO MICROWAVE: GaAsFETs, MMICs, transistors, etc. SASE; WA31AC, 7148 Montague St., Philadelphia PA 19135. BNB771

HAMLOG COMPUTER PROGRAM Full features. 17 modules. Auto-logs, 7-band WAS/DXCC. Apple $19.95. IBM, CP/M, KAYPRO, TANDY, CR8 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

WANTED: Sunair GCU-910A or GCU-935 Antenna Coupler. Ray Dunham, 1030 Hillside Ave., Pacific Grove CA 93950. BNB790

ELECTRON TUBES: All types & sizes. Transmitting Receiving, Microwave...Large inventory = same day shipping. Ask about our 3-500Z special. Daily Electronics, PO Box 5029 Compton, CA 90224. 800–346–6667. BNB792

R-390A RECEIVER PARTS: Info SASE. CPRC-26 military Manpack Radio, 6 meter FM, with antenna, crystal, handset: $22.50, $42.50/pair, radio-only, $9.50. Military-spec TS-352 Voltohm/Multimeter, leads, info: $12.50. $4.50/piece shipping, $9 maximum. Baytronics, Box 591, Sandusky OH 44870. BNB798

QSLs & RUBBER STAMPS—TOP QUALITY! States, World Maps, USA, Key, Shuttle, Globe QSLs. Report Form Rubber Stamps. More! Samples, $1 (Refundable with Order). Ebbert Graphics D-7, Box 70, Westerville OH 43081. BNB807

QUALITY QSL CARDS, RUBBER STAMPS, Envelopes and printed letterhead. Send 45¢ postage or SASE for samples. Large selection at attractive prices. Sandollar Press, P.O. Box 30726, Santa Barbara CA 93130. BNB812

WANTED, MILITARY SURPLUS RADIO EQUIPMENT. We need ARC-164, ARC-102, ARC-114, ARC-115, ARC-116, ARC-150, ARC-159, ARC-182, ARC-186, ARN-127, ARN-118, RT-1158A, APN-195, RF HARRIS RF-280, COLLINS 490T-1, 490T-9, 490S-1, 719A, 618M-3, 618T, 51RV-4, 51Y-7, 562. TOP DOLLAR PAID OR TRADE FOR NEW AMATEUR GEAR. WRITE OR PHONE BILL SLEP, (704) 524–7519, SLEP ELECTRONICS COMPANY, HIGHWAY 441, OTTO NC 28763. BNB816

HUGE K1BV DX AWARDS DIRECTORY, complete rules for over 1015 certificates, 102 countries, 230 pages. $15.50 postpaid. Ted Melinosky, 525 Foster St., South Windsor CT 06074-2936. BNB835

HOME-BREW PROJECTS Lists for SASE. WB2EUF, Box 708, East Hampton NY 11937. BNB845

Barter 'N' Buy advertising must pertain to ham radio products or services.
☐ **Individual (noncommercial)** ..... **50¢ per word**
☐ **Commercial** ..... **$1.50 per word**
Prepayment required. *Count only the words in the text. Your address is free. 73* cannot verify advertising claims and cannot be held responsible for claims made by the advertiser. Liability will be limited to making any necessary corrections in the next available issue. Please print clearly or type (double-spaced).

No discounts or commissions are available. Copy must be received in Peterborough by the first of the second month preceding the cover date. Make checks payable to *73* Magazine and send to: Rebecca Niemela, **Barter 'N' Buy, Box 278, Forest Road, Hancock, NH 03449.**

100 QSL CARDS $8! Shipped postpaid. Free samples. Shell Printing, KD9KW, PO Box 50A, Rockton IL 61072. BNB8859

HOSSTRADERS flea market returns to Deerfield NH June 3. SASE for info. WA1IVB, RFD Box 57, West Baldwin ME 04091. BNB8864

THE NATIONAL HAM SHOPPER. A bi-monthly buy, sell, trade publication (starting in April). Adds are quickly answered and published for fast results. $12/per year. $22.00/per 2 year subscription rate. Ad rates 0.30/word individuals; 0.90/word commercial. Send to PO Box 10738, Elmwood CT 06110. BNB8865

ANTENNA PARTS CATALOG, LOWEST COSTS: Dipole/Quad/Ground Radial WIRE, Insulators, FLEXWEAVE #14-168 strand, center feeds, OPEN WIRE FEED LINE, coax, remote coax switches, relays. Catalog: $2.00. Davis RF, PO Box 230-S, Carlisle MA 01741. (508) 369-1738. BNB8866

CURRY COMMUNICATIONS proudly introduces a complete line of easy to build kits for L.F. and 1750 meters. Please write for brochure. Curry Communications, 852 North Lima Street, Burbank CA 91505. BNB8874

MACINTOSH, ATARI XL/XE/ST, & AMIGA Amateur Radio software. We have several public domain disks available for trade or $4.00 each. Send business size SASE specifying computer for list. Write WA4EFH, PO Box 1646, Orange Park FL 32067-1646. BNB8877

WANTED: All types of Electron Tubes. Call toll free 1 (800)421-9397 or 1 (612) 429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB8878

FOR SALE: Full size schematics. Complete sets for Ranger 4R 3300—$20.00, Ranger AR 3500—$25.00. I.Q. Advertising, 1405 Stevenson Dr., Suite 3 No. 694, Springfield IL 62708. BNB8879

IBM PC, XT, AT, AND COMPATIBLES. Transmitter keyer and code practice program. Features: keys any transmitter, menu driven, 1000 character type ahead buffer, 22 programmable messages, 1–100 wpm (plus selectable speed modifications), selectable practice programs, manual, and much more. Nothing Compares. 100% Moneyback Guarantee. $19.95. Same day return. Lloyd Wilson, 4464 N. Lakewood Dr., San Bernardino CA 92407. BNB8880

EVANGELICAL PASTOR with Advanced Class license, but without ANY gear would greatly appreciate HF equipment donations. Thank you. WD9GMG, 425 East 7th Street, Blue Earth MN 56013. BNB8881

1989 CALLBOOKS: Until 9/15; North American, $21; International, $23. Both, $42. Any six or more, $20. 1989 WRTVH, $16. Postpaid USA. Century Print, 6059 Essex Street, Dept. 73-6, Riverside CA 92504-1588. (714) 687-5910. BNB8882

HERO JR. ROBOT WANTED— Research project will pay—Dr. Henry Dobson—K3AKZ, Bloomsburg University, Bloomsburg PA 17815. (717) 389-4024. BNB8883

DON'T MISS THIS— Ex WWII RAF Bomber Command R1155 Communication Receiver. Perfect condition with circuits. What offers?—Mr. Ray Wilson, Jr., 981 N. Independence, Tucson AZ 85748. BNB8884

RIT KITS for most transceivers, $15. Info only, send SASE. Loren Wallen KA7AZM, 6323 S.W. 100th, Tacoma WA 98499. BNB8885

QUANTITY DISCOUNTS ON TEKTRONIX DUAL TRACE #661 SCOPES (DC-3500 MHz). Excellent condition, $60 ea (lots of 10—$50 ea). Also: Hewlett-Packard Signal Generators 1.8–4 GigaHertz, excellent condition, $50 ea (lots of 10—$40 ea). Also: Various signal generators 1–7 GigaHertz, $50 ea (lots of 10—$40 ea). F.O.B. WW5B, PO Box 460, Brookshire TX 77423. (713) 934-4659. BNB8886

SIX ROOM APARTMENT FOR RENT—INCLUDES TOWER AND BEAM! In Palisades Park, NJ, one of NYC's bedroom communities. Luxury living in modern two-family house. Three bedrooms, two bathrooms, formal dining room. Huge rooms. Giant closets. XYL will love it! Includes garage, laundry room, use of back yard, 60' toweer with rotor, tribander at 55' and 6 meter beam at 60'. Owner moving to Florida, keeping bldg. Asking $1500. Call Greg, WB2GMK. (201) 944-8334. BNB8887

DUST COVERS—Protect your valuable Radio Gear. Custom made, beautiful fit. Send Make/dimensions. Most Radios, $12.95. Catalog, $1. Dinosaur Covers, 173 Foster Road, Lake Ronkonkoma NY 11779. BNB8888

YAESU FT-570 with speaker and mike, 80–10 meter operation, 560 Watts PEP. Good Working Condition. $300 OB Offer. T. Gustafson. (219) 282-2695. BNB8889

SUPER HAM PROJECTS & USED GEAR LISTS! Send SASE to: WA4DSO, 3037 Audrey Dr., Gastonia NC 28054. BNB8890

SURPLUS CATALOG. 72 pages. $2. Surplus, PO Box 276, Alburg VT 05440. BNB8891

220 MHz AMP WANTED. MINT ENCOMM 250 WATT MODEL ONLY. CONTACT WA9KLZ ▮ R.R. 4 BOX 15A, FLOWER IN 47944. OR CALL (317) 869-4073. BNB8892

JARSFEST '89, BENSON NC Oct 1. JOHNSTON AMATEUR RADIO SOCIETY, PO BOX 1154, SMITHFIELD NC 27577. BNB8893

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Good VHF in June

In general, conditions look pretty good for June, with continuing high Solar Flux levels and only occasional Unsettled to Active geomagnetic field. HF in June is not quite as good as during other months, but exceptionally good VHF conditions make up for it.

Stay Tuned

As always, tune in to WWV (I use 10 MHz) at 18 minutes past any hour for the latest Solar-Terrestrial update. In the "best band to use" chart, the following parenthetical notes apply: (1) try 40 or 30 meters; (2) try 15 or 18 meters; (3) try 10 or 12 meters; (*) try 80 meters. Note that with WARC bands active, you may use 30 and 40 together; 10 and 12 together; and 17 and 20 together for openings shown on the band-time chart. ■

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	20	20	20	-	-	-	15
ARGENTINA	15	20	20	20	-	-	-	-	-	10	10	10
AUSTRALIA	-	-	-	20	20	20	15	15	15	-	-	-
CANAL ZONE	15	15	20	20	20	-	20	20	15	10	10	10
ENGLAND	20	20	*40	-	-	20	-	15	15	20	20	20
HAWAII	15	15	15	20	20	40	20	-	-	-	15	10
INDIA	15	20	-	-	20	20	-	-	-	-	-	-
JAPAN	15	-	-	-	-	20	20	20	-	-	-	15
MEXICO	15	15	20	20	20	-	20	20	15	10	10	10
PHILIPPINES	20	15	20	20	-	-	20	-	-	-	-	-
PUERTO RICO	15	15	20	20	20	-	20	20	15	10	10	10
SOUTH AFRICA	-	-	-	20	20	-	-	15	15	15	20	20
U. S. S. R.	20	20	(3)20	20	-	-	20	-	-	15	15	20
WEST COAST	*15	*15	80	80	80	-	20	20	20	20	15	15

CENTRAL UNITED STATES TO:

ALASKA	-	15	15	-	-	(3)20	20	20	20	-	-	-
ARGENTINA	15	15	20	20	-	-	-	-	-	10	10	10
AUSTRALIA	15	15	15	20	20	20	20	20	-	-	-	-
CANAL ZONE	15	15	20	20	20	20	20	20	20	15	10	10
ENGLAND	20	20	20	40	-	-	-	-	-	-	-	15
HAWAII	10	15	15	20	(3)20	(3)20	20	20	-	-	-	-
INDIA	(3)20	(3)20	-	-	-	-	20	-	-	-	-	-
JAPAN	-	15	15	-	-	(3)20	20	20	20	-	-	-
MEXICO	15	15	20	20	20	20	20	20	20	15	10	10
PHILIPPINES	20	20	15	20	-	-	-	-	-	-	-(3)20	
PUERTO RICO	15	15	20	20	20	20	20	20	20	15	10	10
SOUTH AFRICA	-	-	40	20	-	-	-	-	15	20	20	-
U. S. S. R.	20	20	20	-	-	-	-	-	-	15	15	20

WESTERN UNITED STATES TO:

ALASKA	15	15	20	20	20	20	(3)20	20	15	20	-	15
ARGENTINA	10	15	15	20	(3)20	-	20	20	-	-	-	15
AUSTRALIA	10	10	15	15	20	20	40	40	20	-	-	-
CANAL ZONE	15	15	20	(3)20	(3)20	40	80	-	-	(3)15	(3)15	15
ENGLAND	15	20	20	20	-	-	-	20	15	15	-	15
HAWAII	15	15	15	20	20	40	40	20	-	-	15	10
INDIA	-	-	15	-	-	-	20	20	20	15	-	-
JAPAN	15	15	-	20	20	20	40	20	20	20	-	15
MEXICO	15	15	20	(3)20	(3)20	40	80	-	-	(3)15	(3)15	15
PHILIPPINES	-	-	15	-	-	20	20	20	15	15	-	-
PUERTO RICO	15	15	20	(3)20	(3)20	40	80	-	-	(3)15	(3)15	15
SOUTH AFRICA	-	-	-	20	20	-	-	20	20	15	-	-
U. S. S. R.	20	20	20	20	20	-	-	-	-	-	-	-
EAST COAST			80	80	80	-	20	20	20	20	15	15

JUNE

SUN	MON	TUE	WED	THU	FRI	SAT
				1 F-G	2 G	3 G-F
4 F	5 F-G	6 G	7 G-F	8 F-P	9 P	10 P-F
11 F-G	12 G	13 F	14 F	15 G	16 G	17 G-F
18 F	19 F-G	20 G	21 G-F	22 F-P	23 P	24 P
25 P	26 P	27 P-F	28 F	29 F-P	30 P	

AT-300™ Antenna Tuner

An affordable antenna tuner from a name you can trust
The AT-300™ from AEA

Low Pass Design

The low-pass design of the AT-300 is what you would expect from a company where Engineering Makes the Difference. The low-pass design of this AEA tuner means harmonic attenuation for lower TVI potential. This design also allows matching a much wider range of antenna impedances than the common high-pass designs.

Larger Size

One look at the AT-300 lets you know this tuner is different, it's bigger. While some manufacturers promote the small size of their tuners, AEA knows that performance is most important. The simple reason for the larger size is that smaller sizes degrade the inductors' Q (Quality factor), which results in less efficiency. Less efficiency means that for a given power output from your transmitter, less power will actually get to your antenna.

Easy Operation

The AT-300 tuner features a precision frequency compensated dual- movement SWR meter for ease of tuning. The high and low power front panel switch selects the proper range for the SWR meter. The AT-300 is rated for 300 watt operation. The internal balun and front panel selector switch allows for balanced and unbalanced outputs.

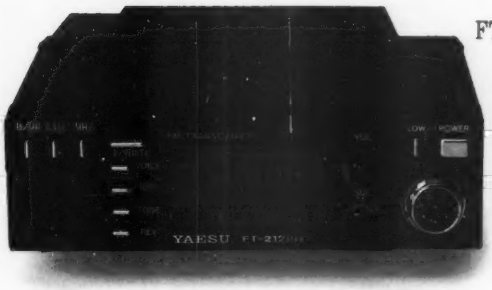
Get maximum performance from your transceiver and antenna by using the AT-300 antenna tuner from AEA. See your local AEA dealer today or contact:

Advanced Electronic Applications, Inc.
P.O. Box C-2160
Lynnwood, WA 98036
206-775-7373

AEA Retail $249.95
Amateur Net $219.95

CIRCLE 65 ON READER SERVICE CARD

TWO OF AMERICA'S MOST POPULAR FM STATIONS.

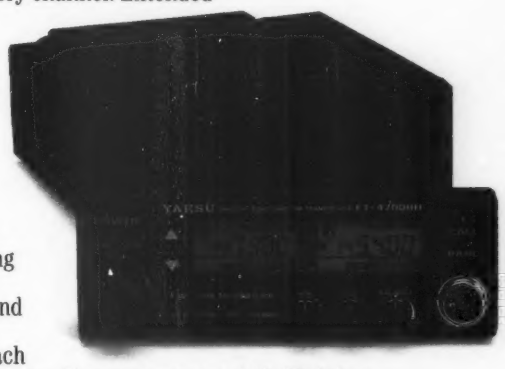


No wonder Yaesu's FT-212R Series and FT-4700RH mobiles are so popular.

Not only are the features unique and plentiful. The operation hassle-free. And the mounting options flexible. But also, each radio now features a built-in PL board. Plus *you* choose the optional mic that best fits your operating and budget needs.

FT-212R SERIES. MOBILES THAT DOUBLE AS ANSWERING MACHINES.

Let the 2-meter FT-212R and 440-MHz FT-712R take messages while you're away (with DVS-1 option)! 45-watt output (35W on 440 MHz). Built-in PL encode/decode. 18 memories. Auto repeater shift. Scanning routines. Offset tuning from any memory channel. Extended receive. Audible command verification. High/low power switch. Oversize amber display. Choice of optional mic. More.



FT-4700RH. DUAL-BAND PERFORMANCE, REMOTE-HEAD DESIGN.

Mount the FT-4700RH almost anywhere—the "brains" on your dash, visor, or door; the "muscle" under your seat. 50 watts on 2 meters, 40 watts on 70 cm. Full crossband duplex. Simultaneous monitoring of each band, complete with independent squelch settings on the main and secondary bands. Built-in PL encode/decode. 9 memories (each band). Extended receive. Reverse repeater shift. High/low power switch. Patch cord for remote mounting. Bright LCD display. Backlit controls. Choice of optional mic. More.

Choose your optional mic: MH-15 C8 DTMF mic, or MH-15 D8 DTMF auto-dialer mic

Want more information? Call **(800) 999-2070** toll-free. Or ask your dealer about Yaesu's FT-212R Series and FT-4700RH mobiles today. Two of America's favorites.

YAESU USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **REPAIR SERVICE:** (213) 404-4884. **PARTS:** (213) 404-4847.

YAESU

Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. Specifications guaranteed only within amateur bands.

ICE CARD

KENWOOD

...pacesetter in Amateur Radio

All New Dual Bander!

Two in the Hand!

TH-75A

2m/70cm Dual Band HT

The new TH-75A Dual Band HT from Kenwood is here now! Many of the award-winning features in our dual band mobile transceivers are designed into one hand-held package.

- **Dual Watch** function allows you to monitor both bands at the same time.
- **1.5 watts on 2 meters and 70cm: 5 watts when operated on 12 VDC (or PB-8 battery pack).**
- **Large dual multi-function LCD display.**
- **10 memory channels** for each band stores frequency, CTCSS, repeater offset, frequency step information, and reverse. A lithium battery backs up memories. Two memories for "odd split" operation.
- **Selectable full duplex operation.**
- **Extended receiver range:** 141–163.995 and 438–449.995 MHz; transmit on Amateur band only. (Modifiable for MARS and CAP. Permits required. Specifications guaranteed on Amateur bands only.)
- **Uses the same accessories as the TH-25AT (except soft cases).**
- **Volume and balance controls, plus separate squelch controls on top panel.**
- **Super easy-to-use!** For example, to recall memory channel, just push the channel number!
- **CTCSS encode/decode built-in!**
- **Automatic Band Change (ABC).** Automatically switches between main and sub band when signal is present.
- **Automatic offset selection on 2 meters.**
- **Tone alert system for quiet monitoring.** When CTCSS decode is on, the tone alert will function only when a signal with the proper tone is received.
- **Four ways to scan,** including ***dual memory scan,*** with time operated or carrier operated scan stop modes, and priority alert.
- **Automatic battery saver circuit extends battery life.**

- **Supplied accessories:** Dual band rubber-flex antenna, PB-6 battery pack, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional Accessories

- **PB-5** 7.2 V, 200 mAh NiCd pack for 1.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** 6-cell AA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-22 and SC-23** Soft case • **SMC-30/31** Speaker mics. • **WR-1** Water resistant bag.

Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

KENWOOD

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
Long Beach, CA 90801-5745
KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

ew
der!
UP
INC.